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## *In this issue*

**326 A.W. 650 Philosophy**
**329 Production Up-to-date**
**331 Call of the North**
**332 High-energy Fuels**
**336 Prophecy in Aeronautics**
**339 One Year Supreme**
**340 Naval Types**
**342 DHC-4 Caribou**
**343 Sagittario II Light Fighter**
**344 Cinderella Transformation**

# Gracious Voyaging

AS the airlines moved—*circa* 1930—from the wicker-chair and walnut-veneer era they began to seek ways of distracting their patrons from fretfulness and boredom. Instinctively they plumped for the gimmicks. Harassed businessmen, Paris-bound at 90 m.p.h., were afforded typing facilities (it being supposed that they would not travel unaccompanied), and every so often an airborne cinema show or mannequin parade would burgeon briefly in the headlines. The unfailing diversions of eating, drinking and smoking were given full play, and the steward or stewardess reigned over all.

As traffic increased, so did the problem of reconciling comfort with speed. While it could hardly be claimed that the renown of Imperial Airways rested in any noticeable degree on the velocity of its airliners, the Hannibals and Scyllas unquestionably had something of the reputation—indeed the appearance—of the Savoy Hotel. But the Empire boats were the true patricians. Clean-lined, majestic and spacious as well as fast, they offered cabins on two decks and a promenade where one could lean against the rail and gaze upon the uneclipsed glories of an Empire. Never were there such aeroplanes; and they were as British as the Medway, where they first graced the water. But they passed, as the clipper ships passed; and those who had known them were left lamenting.

Enough, now, of this reactionary sentimentalism. Are we not promised today, in all the solemnity of hoarding and brochure, that to travel Gargantuair is to travel graciously? Is our epicurean taste not flattered by the assurance that our *filet mignon* will be graciously served, with champagne warranted from France, Europe? Are we not gratified by the gracious company of our fellow passengers—company so urbane that it is a privilege indeed to have it for countless hours at our elbow (rubbing *both* elbows, in the most gracious aeroplanes of all)? And does not this very intimacy promote the most edifying exchanges and most gracious courtesies? What scope for our good breeding is the opportunity of assisting a neighbour to extricate his air-sickness bag or to disengage his seat-belt from the redolent folds of his *burnous*. And what memories remain to us after a modern aerial voyage. It seems but yesterday when the writer was graciously pursuing his trade over the North Atlantic in the temporary company of an American nobleman of some fifteen summers (on vacation bent from his father's Arabian oil holding, he confided). "Say," he addressed us with becoming deference and in the most gracious Texan, "can you fix braces?" With all the courtliness of our nature we professed our unbounded sympathy and instant readiness to assist in his distress. And when he intimated that his embarrassment was of a dental, and not a sartorial nature, what a privilege it was on our part to ring for a steward. And how that good fellow must have blessed the day his fortune sent him into so gracious a calling.

## The Menace of Mozart

Alas, it now appears that the serene dignity of air travel is already being menaced by catchpenny commercialism. The reactionary French, we learn, are seeking to insinuate their own notions of beauty and quiet in place of the gracious living at present offered at such personal sacrifice on the part of airline operators. Consider this insidious official bulletin concerning the Caravelle: "Each row of seats will be provided with a loudspeaker placed next to the aeration orifices, behind a gilt grid. The soundproof and exceptional acoustical qualities of the Caravelle will be exploited to the maximum, since the music of Mozart will be played during the voyages. The separation panels . . . will provide excellent surfaces for masterpieces of art to be hung on each side of the doors."

One can envisage only too clearly some fifty decadent Frenchmen, seated unsociably only four-abreast in the bad old way, heady with *Eine Kleine Nachtmusik*, gazing enraptured upon a little gallery of Corots. Such retrogression of taste, such selfish preoccupation with mere animal comfort and sensory delight, will be resisted by all right-minded devotees of gracious living.

"Flight" photograph

*TWO WINNERS of the Schneider Trophy Race, Mr. Howard Pixton (in 1914, left) and Air Chief Marshal Sir John Boothman (in 1931) met last week at the annual dinner of the Avro 504 Club (reported on the opposite page). They took the opportunity of renewing acquaintance with the famous trophy, which is now permanently in the keeping of the R.Ae.C. at Londonderry House.*

# FROM ALL QUARTERS

## British Supersonics

FORESHADOWED by an article in our issue of March 1, a decision has now been taken to establish a track running north-east from Bedford to the Wash along which aircraft will be allowed to fly supersonically at altitudes well below the current 30,000ft limit.

At present the second Fairey F.D.2, WG 777, is being flown by R.A.E. pilots from the experimental airfield at Thurleigh, and several supersonic runs—at around 30,000ft—have not evoked public protest. Later the height will be brought down in stages to about 10,000ft, although t.a.s. is unlikely to exceed about 800 m.p.h. Elsewhere, both the F.D.2 and English Electric P-1A have flown supersonically at heights of 10,000ft or below.

At a party given by the Fairey Company on March 11, to celebrate the F.D.2's retention of the world's speed record for a whole year (see page 339), Mr. G. W. Hall, acting chairman, spoke of the company's sense of disappointment that there was "no further use" for the F.D.2, although several proposals to match various operational requirements had been put forward. The company had been "handicapped in export orders" by the trend of events. Peter Twiss hoped he might "have another go" in the near future; but that, he said, was up to his directors.

## SC.1 Ready to Fly

TAXYING trials with the Short SC.1 research aircraft (five Rolls-Royce R.B. 108 turbojets) have been completed at Sydenham, Belfast. The aircraft has been taken to Boscombe Down, where Mr. Tom Brooke-Smith, Short and Harland chief test pilot, may have made a conventional take-off by the time this issue appears. He was expected to cut in the four lift-engines at a suitable altitude and start hovering trials.

## Gyron Support Withdrawn

FROM March 31, the Ministry of Supply is to withdraw support for the Gyron, the world's most powerful turbojet. The Treasury, it is stated, cannot allocate funds for an engine which has no official application, and the Gyron is such an engine. The decision of de Havillands to continue with the engine as a private venture shows that they are hopeful that its merits will bring it success—perhaps in France and the U.S.A. as well as with at least one British aircraft company. Development of the Gyron was dealt with in an article in *Flight* last week.

## City of London Squadrons Disbanded

LAST week-end saw the final disbandment ceremony of the City of London units of the Royal Auxiliary Air Force. On Friday, all members of No. 600 (City of London) Sqn., R.Aux.A.F., No. 2600 (City of London) Field Sqn., R.Aux.A.F.Regt., and No. 1 Air Intelligence Unit were received by the Corporation of London in the Guildhall. The squadrons' honorary air commodore, Queen Elizabeth the Queen Mother, the Prime Minister and many distinguished guests were present.

On Sunday afternoon, the honorary air commodore reviewed the final parade at the squadrons' headquarters at Finsbury Barracks (see picture on p. 350). As the R.A.F. Central band played *Auld Lang Syne*, No. 600 Squadron's Standard, the second ever presented to an R.A.F. squadron, was trooped in slow time.

Addressing the squadrons and many of their ex-members, the honorary air commodore recalled the vital part played by pilots and ground crews of R.Aux.A.F. fighter squadrons in the Battle of Britain. Without them, she said, the outcome of the Battle might well have been different. The squadrons could ever look back with pride on the fact that they had been volunteers and were drawn in the main from the City of London, which, from the earliest days, had been defended by its citizens. She thanked the squadrons for their "wonderful standard of selfless devotion." Their record of unfailing loyalty and service to their country would never be forgotten.

S/L. J. M. Cormack, C.O. of No. 600 Sqn., thanked Queen Elizabeth the Queen Mother for the gracious interest and support she had always given to her two squadrons. He hoped that they had in some small way lived up to her courage and example. To those who had serviced and maintained the aircraft, and those who had guarded them on the ground, should go the highest praise; for without them the squadrons could never have operated. He assured the honorary air commodore that her squadrons would always be ready in the future, should they be wanted.

The parade then marched past and proceeded through the City, passing the Mansion House, where the Lord Mayor of London took the salute. Finally, the Standard was taken to the Priory Church of St. Bartholomew the Great, Smithfield, where the honorary air commodore attended the service at which it was laid up. The commanding officer handed it to the Rector, the Rev. Dr. N. E. Wallbank, "for safe lodging in the House of God for all time, until such time as it shall turn to dust."

## German Sycamores

ON Friday last a contract for 50 Bristol Sycamore Mk 14 helicopters was signed in Coblenz by the Director of the Ministry of Defence on behalf of the Federal German Government. The aircraft are to be used by units of the German Army, Navy and Air Force for ambulance, air/sea-rescue and transport duties. Valued at "several million pounds," the contract is one of the largest ever placed with a helicopter manufacturer, and it was obtained after a competitive evaluation of all available types, including those manufactured in the United States.

## Bréguet Trophy for Paul Morain

THE Royal Aero Club announced last week that the Louis Bréguet Memorial Trophy for 1956 has been awarded to M. Paul Morain, chief engineer (helicopters) of Sud-Aviation.

The trophy was presented early last year to the R.Ae.C. by the late Sir Richard Fairey, in memory of the French aviation pioneer Louis Bréguet, who died in May 1955. It is awarded annually "for meritorious achievement in the development of helicopters or other vertical-take-off aircraft."

M. Morain, who has devoted most of his engineering career to the development of helicopters, worked with Bréguet for many years.

## R.A.F. Manpower and Equipment

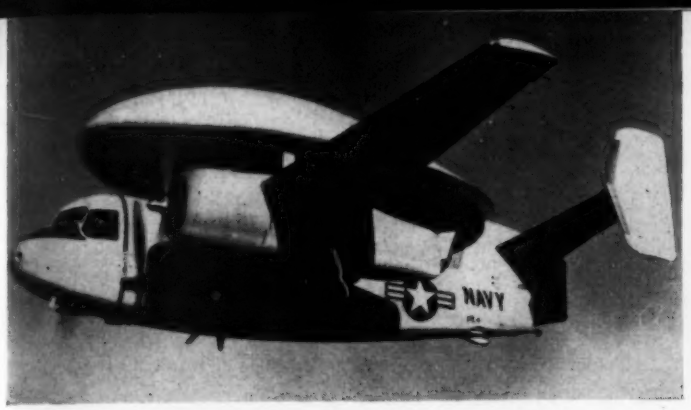
PRESENTING a £240 million vote on account in the House of Commons on March 7, Mr. George Ward, Secretary of State for Air, said he did not wish to anticipate too much of what would be said later in the Air Estimates Memorandum.

Though the R.A.F. wanted rockets as soon as it could get them, it would clearly be unwise to throw away manned aircraft in any rôle until there was a proven weapon to take their place. Our V-bombers were as effective as any bombers in service in the world, and the Hunter and Javelin were capable of intercepting any Russian bomber now in service. In time, of course, the bomber threat would get faster and then the English Electric P.1 would replace the Hunter. The development of this aeroplane had happily been relatively smooth and a production order had been placed.

The main object of the improvement in conditions of service, introduced a year ago, was to increase the number of Regular recruits and to encourage men to sign on for longer-term engagements. The Air Ministry had had a good deal of success in both these aims, although they wanted to increase Regular recruiting even further. By way of examples Mr. Ward said: "From April to December last year there was an increase, compared with the same period for 1955, of nearly 15 per cent in Regular recruiting from civil life. The number of people rejoining from civil life, with previous R.A.F. service, has also been most encouraging. So, too, have the numbers of airmen already serving who have extended their service or re-engaged to pensionable age. Airmen serving on engagements of twelve years or more have gone up from 44,700 in April last year to 51,100 in December."

Twenty-seven officers and a hundred airmen were at present at Woomera, and these numbers would increase this year.

Mr. Ward went on: "At our first G.W. station, where we will carry out training on surface-to-air rockets, we are building a




***SEA SAUCER:** Modified from a production Grumman TF-1 Trader (transport version of the S2F Tracker) the grotesque aircraft on the left is an aerodynamic test prototype for the WF-2 fleet early warner. Apart from the huge radome, the new machine differs in having a three-fin dihedral tailplane.*

***STANDING ARRANGEMENT:** The Hiller research "flying platform" for the U.S. Army soars high on the power of its ducted fan. Two multi-engined versions are now on order. The picture conjures future-war visions of duels between soaring snipers.*

simulator. This can reproduce synthetically attacks by enemy aircraft and it enables teams to practise interceptions under realistic conditions."

Later in the proceedings Mr. C. I. Orr-Ewing, Under-Secretary for Air, gave an assurance that the progress of the Miles M.100 Mk 3 trainer would be followed "with considerable interest." But given the time scale of the development of this aircraft and of the Jet Provost, he said, it would have been entirely wrong to have delayed the introduction of a jet trainer into the R.A.F. until there had been time to consider the Miles M.100.

The advent of the Comet squadron and of the Beverleys in the past year had doubled the capacity of Transport Command in terms of seats. The Comet had now flown more than a million miles in R.A.F. service.

## Fiat G.91 Prototype Lost

THE first prototype of Fiat's G.91 light fighter for NATO was destroyed recently during a routine test flight. Some reports state that the aircraft "exploded in flight." Major Bignamini, the test pilot, who used his Martin-Baker lightweight ejection seat, sustained minor injuries on landing.

## Report on the Swift

IN a report on Appropriation Accounts, Sir Frank Tribe, Comptroller and Auditor-General, estimates that the cost of supplying 129 flyable Swift aircraft to the R.A.F. (28 of them subject to operational limitations) was about £40 millions.

When the original production contract for a hundred airframes was placed in November 1950 the estimated cost was £28,875 each. In February 1955 the order totalled 492 aircraft, of which 39 had been delivered, and the estimated cost had risen to £65,000. At that time it was decided that the first three marks were not up to Service standard, and that the Mk 4 could not be relied on at height.

In consequence, orders were reduced to 170 aircraft, excluding prototypes, eighteen being for the Ministry of Supply and 152 for the R.A.F. R.A.F. orders comprised 28 Mks 1 and 2 (subject to operational limitations), 23 Mk 3s (delivered by road for ground-instructional purposes) and 101 Mks 5 and 7. Sir Frank's report continues:—

"Payments under the contracts for airframes are expected to total over £32 million. This includes £6.6 million for cancelled orders and £5.4 million for cost of prototypes. If the remaining £20 million is divided among the 170 aircraft delivered the cost of each airframe would be about £120,000. The Ministry have informed me, however, that the total cost of these aircraft includes a substantial element for expenditure not attributable to the production of the number of aircraft delivered, e.g., the cost of tooling provided for the production, at a high peak rate, of a total expected programme of some 800 or 900 aircraft and the cost of converting a number of the aircraft completed or nearly completed to one mark (Mk 4) for final delivery as a different mark (Mk F.R.5). In addition to the airframes, the cost of engines (£5 million) and other equipment for the aircraft is understood to total some £8 million and the total cost will therefore be about £40 million."

The report concludes with some observations on the subject of improved procedure in ordering aircraft:—

"In reply to my inquiry whether . . . any changes in the procedure for controlling contracts for aircraft have been introduced, I was informed that since the Korean war the Ministry of Supply have introduced a number of changes of procedure which are intended to adapt the methods of controlling contracts to the conditions governing the supply of the latest types of aircraft. Some of these have been introduced since the cancellation of the Swift contracts, though not entirely as a consequence. For example, having regard to the growing complexity of aircraft, all the main aircraft constructors have been asked to make their technical reports on the flight tests of prototypes more informative; arrangements have been made by contract clause for aircraft under development to be sent to Boscombe Down for preliminary testing by official pilots before the contractor's flight trials are finished; Development Project Officers have been appointed for each main type of aircraft under development to concentrate responsibility for supervising the progress of the work; improvements have been made in the control of the early stages of production of aircraft, particularly those which precede the completion of development; and acceptance of aircraft which do not reach the standard aimed at is being arranged by specific contract amendment."

## The Duke at Decca

ON Thursday of last week the Duke of Edinburgh visited the Decca organization, beginning his tour with a 45-minute trip down the Thames in the company's demonstration vessel *Navigator*. Attended by his equerry, Capt. F. D. Roberts, R.M., Prince Philip was received at Tower Pier by Mr. E. R. Lewis (chairman of the Decca group) and by Lord Waverley (chairman of the P.L.A.) and other officials.

The P.L.A. vessel *Ravensbourne* had been made available to act as a radar target and His Royal Highness was given a demonstration of both Decca radar and the Decca Navigator. He showed particular interest in the new true-motion radar and in the Decca Navigator marine automatic plotter.

After returning to Tower Pier, Prince Philip went by road to the Decca factories at New Malden, Surrey, where he lunched with the directors of the two companies and civic representatives.

After lunch, the royal visitor inspected an exhibition of radar and Decca Navigator equipment, showing particular interest in aircraft applications of the Navigator system, including the new long-range Dectra equipment. Following this he made a tour of the factories, pausing frequently at the benches to talk with the men and women employees.

Concluding with a tour of the Decca record factory, the visit lasted from 11 a.m., the time at which Prince Philip had reached Tower Pier, until 4.30 p.m., when he left Malden.

## More Zip Fuel

SINCE the article on high-energy fuels (pages 332-4 of this issue) went to press it has been announced that constructional work has started on a new factory in America for the manufacture of such products; it will be the largest such plant in the world. Costing £13.6m ($38m), it is to be a facility of the Callery Chemical Co., Callery, Pa, and it will produce boron-based fuels for the U.S. Navy.

## Sixth "504" Re-union

GUEST of honour at the sixth annual reunion dinner of the Avro 504 Club was Air Chief Marshal Sir John Boothman. The occasion was celebrated at Londonderry House last Friday.

This year there was a special cause for celebration, for the dinner was also chosen to mark Sir Alliot Verdon Roe's eightieth birthday, which actually occurs in a few weeks' time, on April 26. Sir Alliot was in spendid form and, during the course of the evening, he presented the 504 Club Trophy to Mr. D. Brailsford, this year's outstanding Avro apprentice, and the fifth to win the award. Sir Alliot himself received, from the hands of Sir Roy Dobson, a beautiful silver salver signed by all Club members to mark the esteem and affection they felt for "A.V." and Lady Roe. Paul Wilkinson, a 504 member in America, also sent a signed copy of his latest book on aero engines. These gifts, said Sir Alliot in reply, were "very undeserved, because you can't help getting old." His speech was an amusing one, recalling, as is the custom at these dinners, events in the earliest days of flying in the United Kingdom.

The toast of "The Company" was well honoured by Frank McKenna, and Sir Roy Dobson replied briefly but adequately.

"Our Guests" were then proposed engagingly by Clifford Horrax, and Sir John Boothman replied by recalling many incidents concerned with Avro and other aircraft. Sir John made his first solo at Hendon on March 4, 1917—the aircraft was not a 504, but a Caudron.

The recipient of the apprentices' trophy, D. Brailsford, thanked the company sincerely and appropriately. He said that there were seven applicants for every place offered. Aviation was the most fascinating career a young man could choose today.

# A.W. 650 Philosophy

## *The Background and Current Progress of a Promising Civil/Military Transport*

*Grouped around a display model are, l. to r.: D. A. Woodley, asst. chief designer (tech.); D. L. Raffle, chief performance engineer; R. Dean, asst. chief designer (projects); E. D. Keen, chief designer; H. J. Staite, chief research engineer; A. J. Troughton, chief structural and mechanical engineer; and H. F. Butler, A.W. 650 project designer.*

LAST week we were invited by Sir W. G. Armstrong Whitworth Aircraft, Ltd., to discuss the A.W. 650 transport project with several of the company's engineers who are responsible for its development. The 650 (a full introductory account and basic description of which was published in our issue of January 18) is undoubtedly one of the most important transport aircraft projects in the world, and the design offers a number of substantial advantages which should ensure its commercial success.

Its history dates from the autumn of 1955 when Armstrong Whitworth were invited to submit (as a secret project) a study for a multi-purpose military transport aircraft. Bearing in mind the fact that such a machine would be likely to have civil applications, the firm were asked what contribution they would be prepared to make towards the costs of development. In order to obtain a rough appraisal of the commercial prospects of such a machine, the chief performance engineer, Mr. D. L. Raffle, and Mr. B. P. Hough of the sales director's staff, undertook a quick sales-tour. At this time the studies were designated A.W. 66 (military) and 65 (civil), and they specified twin 3,000 h.p. turboprops and a conventional (i.e., not twin-boom) configuration.

Conferences were held with the Ministry of Supply, and the entire project was finally turned over to the Ministry of Transport and Civil Aviation and to the company itself, and it has, since that time, been regarded principally as a civil programme with military applications, rather than *vice versa*. With the backing of the Hawker Siddeley Group the company took the bold step of undertaking the entire design, manufacture, development and initial production as a private venture. They have decided to go ahead along the lines which they feel will produce the best results and will then offer one or more military equivalents of the finalized civil aeroplane.

Armstrong Whitworth accordingly undertook an extensive market-survey study in order to determine the correct powerplant, cross-section of hold for maximum flexibility, payload/range diagram and other fundamentals. As a result the hold was widened and lowered, and the whole aircraft was reappraised to fit it for the widest possible market.

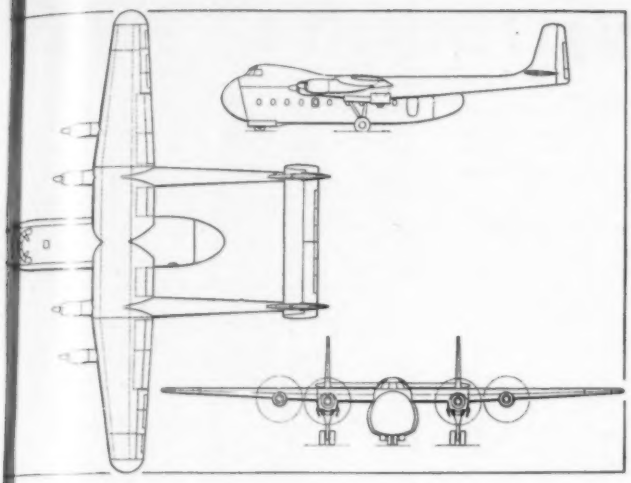
At the outset, of course, it was essential to decide whether to use two big engines or four small ones. Choice of engine is fundamental to success in the civil field, and it was soon firmly decided that initial selection of a thoroughly well-tried and reliable unit must be a back-marker of the entire programme. The Dart was thereupon chosen and the project was redesignated A.W. 650. The Dart is considered to be the optimum engine by the vast majority of the possible customers to whom Armstrong Whitworth have spoken. For long-range operation, and under a variety of special conditions, the twin-engined machine is more attractive, and the A.W. 651 has been planned with two Rolls-Royce Tynes.

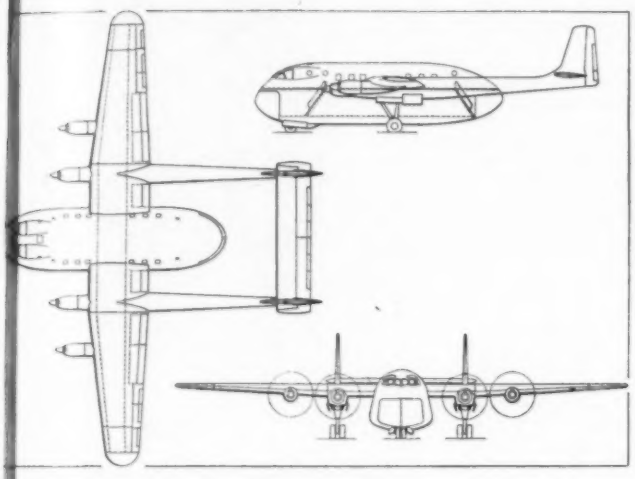
As we described in the issue mentioned above, the basic machine has a pressurized fuselage of roughly circular section offering unobstructed volume for all kinds of useful load. There was little unanimity among operators on the score of loading arrangements, but, following a strong lead from British independents, it was decided to provide straight-through loading at both ends by cutting off each end of the hull and leaving a simple circular seal between the fuselage proper and the single (not clam-shell) hinged end-doors. Nevertheless, the optimum fuselage for one operator was soon found to be quite incorrect for another, and before many months had passed the A.W. 650 had branched out into a family of aeroplanes each matched to a particular type of operation. It seems to have been a sound move to adopt the twin-boom configuration, with the main undercarriage retracting into the booms. This has allowed the tail/boom/wing/powerplant combination to form a basic carrying vehicle for at least three distinct fuselages.

For example, the basic military machines are the A.W. 660 (four Darts) and 661 (two Tynes) both of which have an integral ramp at the rear for dropping of heavy stores. Another design is the A.W. 670 car-ferry, with an unpressurized double-deck fuselage of tremendous proportions, and the related A.W. 671 short-range bus intended for high-payload operation over short stages and seating some 130 passengers in quadruple seat units on each side of a central aisle.

At present, however, the main task is the development of the basic A.W. 650 as depicted in the upper drawing (p. 327). In many senses it is a co-operative project between Armstrong Whitworth, the remainder of the Hawker Siddeley Group and a number of

*As yet uncompleted, the first mock-up (wood skeleton and metal skin) is already impressive. The pressurized region behind the flight deck will house systems components and will be faired neatly into the wing.*





*Utilising virtually identical wing, tail, powerplants and landing gear, the A.W. 650 (left) and A.W. 670 (lower left) are but two members of a versatile family. Both will be cleared to operate at around 82,000 lb, and the former promises to have a D.O.C. of about 7d per 2,000-lb statute mile. New weight data are: basic equipped, 39,000 lb; max. landing, 73,000 lb; and zero-fuel, 70,000 lb. Max. payload is 28,000 lb.*

## A.W. 650 PHILOSOPHY . . .

outside companies. All major sub-contractors are helping with a certain amount of credit, in that payment for at least one set of prototype components will not be requested until sales of the final aircraft have started.

Chief of the sub-contractors is, of course, Rolls-Royce whose Dart RDa.7/2 of 2,100 e.h.p. is matched with a Rotol propeller of 11ft 6in diameter. Sir George Edwards, of Vickers-Armstrongs, agreed to let Armstrong Whitworth buy Viscount-type powerplants complete back to the fireproof bulkhead. This installation already has a full British and American C. of A. and should save A.W.A. many months. The undercarriage is being bought from a specialist firm and in geometry the main units are Chinese copies of those for the Friendship (but on a larger scale).

During the preliminary design it was found that the optimum wing was almost coincident in outer form with that of the Avro Shackleton Mk 3. After carefully evaluating the whole picture, it was eventually decided to place much of the responsibility for the wing with Avro, to use the Shackleton 3 design as a basis and, as far as possible, to employ the existing jigs, tooling and established methods of the Manchester plant. Fatigue experience with this wing is very great, and the safe life can be predicted with confidence (in normal operation it is placed well beyond 30,000 hr). The final A.W. 650 wing is now much modified from that of the Shackleton; it has quite a different form of stress distribution, provision is made for the tail-boom attachments, the engine spacing is different, thermal anti-icing is standard and high-lift, double-slotted flaps are fitted. Choice of the latter type of flap may, in the distant future, give way to blown flaps, although the latter would require an auxiliary source of air such as a Rover or a Blackburn-Turboméca gas turbine.

Final design of the complete tail unit is being undertaken in the drawing office of the sister company of Gloster Aircraft. The tail is supported on long monocoque booms of roughly oval section extending from the rear of the inboard engine nacelles. Early in the life of the design rumours were current to the effect that Fairchild had experienced considerable structural trouble with such an arrangement; but discussions with the American manufacturer convinced Armstrong Whitworth that, provided the airframe was properly designed, twin booms could be employed with complete assurance and at a reasonable weight. Discussions were also held with Nord, whose Noratlas employs a similar configuration. The French company were found to employ coincident stress methods and to have achieved complete structural success.

A very extensive test-programme, considerably in excess of that required to satisfy the A.R.B., is already in hand to prove the structure and systems of the A.W. 650. In the basic analysis of the airframe one digital computer and two analogue computers are being employed. The digital machine is a Ferranti Pegasus and it is being fully utilized in performance analysis and structural work, and programming for the normal-mode investigations is currently taking place. One of the analogue (Avro) computers is at work on flutter; the other is a response simulator working on all kinds of dynamic flight problems, including pilot-initiated manœuvres and landing cases. Two water tanks are being built at the company's design centre at Whitley for fuselage testing and for a fatigue investigation on a complete airframe. Static tests of the wing will be undertaken by Avro.

In addition to the two airframe test-shells, work is currently in hand on three prototypes which are scheduled to fly in October 1958, December 1958 and February 1959. Between April 1959 and March 1960, seven pre-production A.W. 650s will follow. This may seem a prodigal expenditure of company finance, but—in the words of the chairman of Rolls-Royce—Armstrong Whitworth are "planning for success"—which is, of course, the logical thing to do. The ultimate aim is to make available a fully certificated aeroplane at the earliest possible moment. At present the firm are slightly ahead of schedule.

While visiting the company we inspected the first mock-up at Baginton. Provision for radar is to be made in the centre of the hinging nose, which will also accommodate a crew-toilet and a large baggage compartment. Up the stairs to the flight deck one finds what promises to be a conventional and very pleasant cockpit. Normally the aircraft will be flown by a crew of two, although provision is made for three, and the aircraft can be ferried solo. The only roof panel is that for radio, which occupies a small area on the centre-line. Specified equipment includes the Smiths Flight System and S.E.P.2 autopilot.

Commercial success seems certain for both the A.W. 650 and the military A.W. 660, and the high-capacity derivatives also seem assured of a small but important market. The machine is being marketed by the complete Hawker Siddeley Group, and the great sales-organization of Rolls-Royce is also likely to be of no small assistance. It is far too early to start discussing particular sales-prospects, but it may be worth recording that the 1/12-scale model of the machine which is to be exhibited at the forthcoming Paris Salon will include all three types of fuselage, and that the A.W. 650 fuselage will be finished in the markings of one airline and the A.W. 670 will bear the livery of another.

*On entering the A.W. 650 mock-up the width of hold becomes very apparent (the maximum is 140in). The flat roof is caused not by the wing but by the flight deck floor. This view is looking forward.*

# HERE AND THERE

### Royal Night-flying Practice

PRINCE PHILIP has resumed routine night-flying practice, following the four months' absence on his recent Commonwealth tour. He flies a Heron of the Queen's Flight, with S/L. B. G. Stanbridge as second pilot, taking off from White Waltham and utilizing the night-landing aids at Blackbushe.

### Supersonic Prince

ON his recent visit to the U.S.A., Prince Bernhard of the Netherlands had his second experience of supersonic flight—this time in a TF-102A two-seat trainer, at a Convair airfield. He also visited Fairchild's premises, where the Fokker Friendship is being built under licence.

### Friendly Visit

DURING his recent visit to Holland the C-in-C. of the West German Air Force, Lt-Gen. Josef Kammhüber, went to the Fokker factory and flew from Amsterdam to Eindhoven in a Friendship. On his visit he was the guest of Gen. H. Schaper, Chief of the Netherlands Air Staff.

### F-86 Conversion

UNDER a $25,000,000 U.S.A.F. contract North American Aviation are converting over 800 F-86D Sabres to the F-86L configuration. The new model is believed to be equipped for firing beam-riding guided weapons and carries a great deal of new electronic and armament equipment. The first order (just over $4m) provides for the conversion of 355 aircraft.

### Helicopter Exploration

A BELL 47G of Helicopter Services, Ltd., Hamilton, New Zealand, is being used to fly-in surveyors, workmen and supplies to the upper reaches of the Whakatane River, which are under exploration as a potential source of hydro-electric power. This is the first time the N.Z. Ministry of Works has used a helicopter for such an operation.

### Messerschmitt Reorganization

FOLLOWING a financial reorganization, the Messerschmitt company in Munich is starting work on its contract to build 300 French Fouga jet trainers under licence for the German Air Force. Under the new arrangements, Dr. Fritz Rudorf, director of the Hamburg State Bank, succeeds Prof. Willi Messerschmitt as chairman of the Board; the State of Bavaria takes over 49 per cent of the stock, the Messerschmitt company retaining 49 per cent and the West German Federal Government holding the remaining two per cent.

### Manchester Aeronautics Degree

IN October, Manchester University is to inaugurate B.Sc. courses in aeronautical engineering. It is hoped to establish additional facilities at Barton Airport, where the University already has an experimental section of its Mechanics and Fluids Department.

### Pioneering in Reverse

TWO replicas of famous aircraft—the Lilienthal glider of 1891 and the Wright brothers' biplane of 1903—are being built in Holland and later this year will be housed in the Dutch National Aviation Museum at Schiphol Airport, Amsterdam.

### Beryllium Buyer

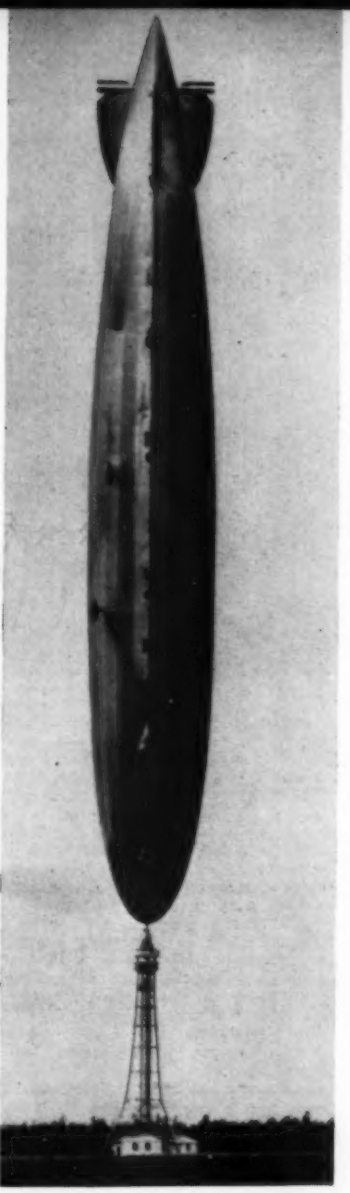
ARGENTINA'S entire 1956 production of beryllium, a strategic metal used as a constituent of shielding material for atomic reactors and in certain parts of gas turbines, has been bought by the United States, reports the Argentina Trade Promotion Institute. The quota of 2,100 tons of 10 per cent ore offered by the Argentine (which produces 35 per cent of the world's supply) went to the U.S. Government at $370 a ton.

### Hustler Latest

THE supersonic Convair B-58 Hustler has been flying for over a month with its "mission pod" (pictured in our issue of March 1). It is now learned that the aircraft fitted with the pod—and, presumably, full operational equipment—is actually the second Hustler, serial number 55-0661. The U.S. Air Force has also published revised dimensions which show that the B-58 is slightly larger than was at first reported; the new data are: span, 57ft; length, 97ft; height, 31ft.

### Aeronautical Meteorology Course

A RESIDENTIAL course devoted to *Weather and Flight* is to be held from July 3 to 10 at Preston Montford Hall, near Shrewsbury. Organized jointly by the Field Studies Council and the Royal Meteorological Society, with the support of the Royal Aeronautical Society, the course will explain the basic principles of cloud physics and air dynamics and interpret the natural phenomena of weather and the artificial phenomena of flight. Lecturers for the main course will be R. S. Scorer, M.A., Ph.D., of Imperial College, C. E. Wallington, M.Sc., of the Meteorological Office, and F. G. Irving, M.Eng., of Imperial College. The fee for the course will be about £8; further details from The Warden, Preston Montford Field Centre, Montford Bridge, near Shrewsbury, Salop.



*COCK-EYED WORLD: Discovered by John Toland and printed in his book "Ships in the Sky" is this astounding picture of the dirigible "Los Angeles," taken by the U.S. Navy at New Jersey in 1926. A fresh breeze flipped the 700ft craft on to its nose without serious damage or injury to the crew.*

*COMBINED OPERATION: Now in service for communications and reconnaissance duties with the United Nations Emergency Force in the Suez Zone are four DHC-3 Otters, based with No. 115 Communications Flight of the R.C.A.F. at Abu Sueir. Markings of the aircraft—two of which are seen here just before leaving the makers' Downsview, Ont., factory—include the U.N. crest on fin and wings and "United Nations" in bold red letters along the fuselage.*

### Spring on Wheels

A SPECIAL issue of our associated journal *The Motor Cycle*—the "Spring Number and Buyers' Guide"—is being published on March 21. Of interest to motor cyclists in general (and in particular to those thinking of buying new machines), it will contain details of all new motor cycles, sidecars, motor scooters and cyclemotors, plus much other helpful information.

# PRODUCTION UP-TO-DATE

## *A French Constructor on Modern Tooling Methods: The Tenth Louis Blériot Lecture*

THE Louis Blériot Lecture was given this year by M. Badre, production director of Ouest Aviation. It was delivered as a main lecture of the Royal Aeronautical Society on March 7, at the Institution of Mechanical Engineers.

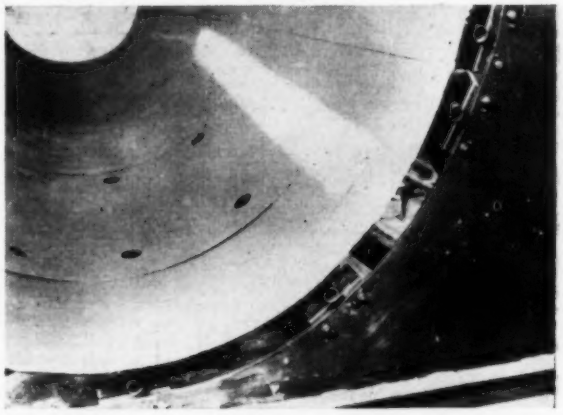
Introducing his subject, *Modern Methods of Aircraft Production*, M. Badre said that nowadays it was essential to apply the most advanced engineering methods available to the industry. This had not always been the case; until quite recently the use of thin sheet metal, and the comparative simplicity of the shapes into which it had been formed, meant that repairs and replacements of parts could be made "by an operator, doubtless skilled, but with loosely defined responsibility." Today, he said, aircraft were made of thick sheet metal in complicated shapes and it was necessary to proceed in a manner that would enable any part to be applied to any aircraft without special fitting. Reduced tolerances meant that machine tools must be made more rigid; stamping machines must be particularly well made, and assembly jigs must remain carefully aligned.

After reviewing the manufacturing methods most widely in use (machining from large forged components, copy milling, spar milling and stretch forming) the speaker reminded his audience that it had been realized for some time that the fewer parts making up an assembly the lighter it would be for equal strength. "It is," he said, "advantageous (from the strictly theoretical point of view) to start with thick light alloy or steel slabs and to scoop the form out of a solid. This is better than starting with sheets of constant or tapering thickness and—to give them sufficient local rigidity—to assemble onto them longitudinal and transverse stiffeners of more or less complicated shapes. Starting with a thick slab and actually scooping it out of the solid, it is clear that, as regards uniformity of the whole, the result is more satisfactory than the structure which has been assembled, even in the case of glueing."

It needed very complicated equipment and large ingots to pursue this process, and the finished components—particularly in the case of milled spars—required to be straightened in presses or "bulldozers." This was in spite of intermediate heat-treatments in order to give stabilization. To overcome this difficulty consideration had even been given to the use of quenching under pressure in special presses.

A great saving in expense [the smallest machine for milling skins cost about $100,000] could be made by chemical milling. In this process a panel was suitably masked by glueing special paper or waterproof cloth to the surface to be retained and a corrosive liquid (generally caustic soda for light alloys or an acid for steel) was applied over the whole surface for a controlled time. Straightening could usually be dispensed with, because the additional stresses from the action of a tool were not incurred.

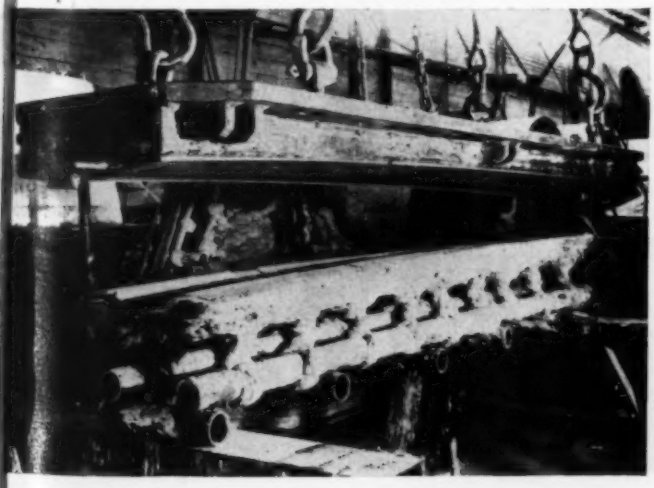
Discussing next the technique of large-scale production, the lecturer said that there was only a limited application in aviation for the use of so-called "automation." This applied mainly to the use of transfer machines; automatic handling devices were extremely costly and their purchase was not justified for aircraft production.



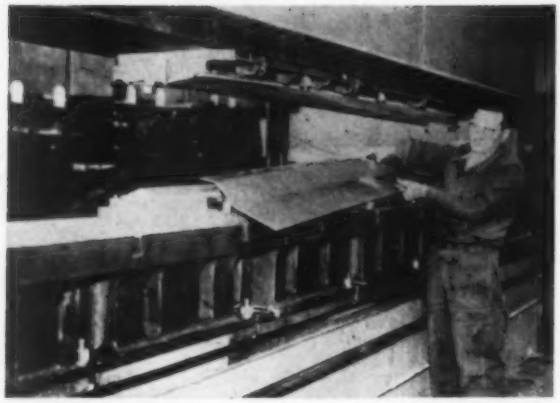
*Casting a plaster contour mould for the fuselage spar of the Vautour from a plastic fuselage shell. The shell is a cast taken from another plaster model of the complete rear fuselage.*

M. Badre devoted considerable attention to the manufacture from full-scale plaster models of tools for large sub-assemblies. Taking a fuselage section as an example, he related how a hollow plastic mould could be cast over it. This mould could then be used to produce a further mould into which a thermosetting plastic substance could be poured, finally enabling the press tool to be made. By applying a coat of what was called a separator—i.e., a very thin film of a special product—the resin was kept from adhering to the plaster and definition lines scribed on to the plaster model could be made to stand out in the mould. The lecturer claimed for this method that a tool for flanging or drawing or the basis of an assembly jig could be produced without the possibilities of error inherent in working direct from drawings. The longitudinal fuselage stiffening spar of the Vautour aircraft was an illustration of the technique. Here a plaster model of the spar was built on to the hollow form already obtained and the model then used to cast the contoured pressing tool required to make the spar. This particular Vautour component was made on a large bending machine in the St. Nazaire works of Ouest Aviation. "The use of more conventional methods," said M. Badre, "would have demanded tools which would probably have taken several months to produce and several weeks to perfect."

Turning to methods of assembly, the lecturer paid a tribute to the development work that had been done by the Fairey Aviation Company. Until recently, he said, assembly was always begun by setting up a skeleton of the unit and then applying a skin to it.



*The plaster cast seen in the photograph above is hand-contoured to the required shape and an impression of it is taken (allowing for the gauge thickness of the spar) on the reinforced mould seen below. On the left the press tool made from this mould is being contour-checked.*



*The final stage of manufacture of the spar which longitudinally stiffens the Vautour fuselage. The material, pre-bent on a large bending machine, is pressed to the exact contour of the inside fuselage skin.*

## PRODUCTION UP-TO-DATE . . .

This rather difficult operation caused deformations and buckling. The Fairey Aviation Company were the first to conceive the idea of equipment which started the work of construction from the outside instead of from the inside. The skin, already provided with its various stiffeners, thus becomes the basic component on which the various pieces of the skeleton were fixed, and the assembled unit was perfectly smooth, with no deformations or internal stresses.

Fairey's method was to make a former having the exact shape of the skin and to mark on its surface the various drilling and attachment points for fastening the skin panels and stiffeners into place. A French variant of this method was to have plastic counter-moulds for the outside walls of the former (generally made of epoxy resins with various additives) on to which would be fixed the attachment points of the other components of the structure. These epoxy resin counter-moulds were obtained directly from the plaster models mentioned earlier, so that these were used not only to make tools for the main skinning but also for their assembly on to the jigs.

The advantage of this process was immediately apparent; both the components and their assembly jig came from the master model, no difficulty arose in assembly, the tooling was adjusted right from the beginning and the parts fitted into the jigs and their parent assemblies from the start. The first experience with this technique, the speaker said, was obtained in France on the Marcel Dassault Mystère IV, and it had since been in general use for Vautour production, where almost every aircraft was made according to this method [over 140 Vautours are being built—Ed.].

The complexity of the technique was justified, since the first production aircraft was assembled as easily as the tenth, fifteenth or twentieth. Practically no modifications had to be made to the tooling, a fact which justified the manufacture of very large plastic components with fairly precise tolerances. The trouble taken at that stage was largely compensated by the ease with which even a complicated fuselage like that of the Vautour was assembled and took shape in the assembly jigs.

For large-scale production there was a tendency—it had been in evidence for several years—to produce various types of equipment sub-assembly separately; wiring was placed in looms, pipes in systems and the complete assemblies on predetermined supports with the minimum of fixing and the least expenditure of labour.

A technique which has been in use in France for a number of years and which was now being applied to the Electra was the manufacture of a full-scale metal mock-up. By this method a model of the aircraft was made from rejected parts. With its aid, specialist staff could take time to consider all the positions for the pipes, supports, wires and instruments, and in this way even very complicated assemblies could be worked out at leisure and later manufactured by sub-contractors.

Some of the methods used in the motor car industry, in the lecturer's opinion, were applicable to the manufacture of aircraft. One of the best known of these was the single assembly line in which, for each operation of fitting and assembling, there was only one piece of equipment and one assembly jig. An increase in the rate of output was obtained merely by a greater simplification of the line, that is, by reducing the number of operations performed on each assembly. This line was fed by parallel lines on which the sub-assemblies and their auxiliary equipment were made, and the parallel lines might be situated in a separate shop.

It had also been proved more economical to use two sets of jigs for certain components: it cost much less to make a single-operation jig—even though a large number were required—than to construct several very large assembly jigs. A further advantage was that less-skilled operators could be used to perform a number of simplified operations.

Looking ahead, M. Badre foresaw the increasing use of plastic materials for making tools and parts, with machining and forging used to a greater extent than ever before on components of increasing complexity. The use of reinforced, pre-stressed concrete for missile applications was a new process that was being undertaken in France. In the years to come, he suggested, production engineers would be fully occupied, with plenty to do, plenty to think about and plenty of material on which to exercise their inventive powers.

# VICTOR AND VICTORS: A RADLETT CONJUNCTION

*That this photograph was carefully staged—to publicize two widely contrasted products that happen to have the same name—in no way detracts from its dramatic impact. Having remarked that both also share the highest standards of design and workmanship, the manufacturers concerned append the solemn thought that if the Vauxhall Victor had the Handley Page Victor's fuel capacity "it would travel many times round the world without stopping to fill up." Executing this impressive piece of fast-and-low, incidentally, was H.P. assistant test pilot J. W. Still.*

# Call of the North

## *Alaskan Operators Launch a Come-to-the-Arctic Campaign*

UNITED STATES and Canadian aviation interests are behind a drive to open up to tourism the largely frozen territories of the Alaskan Eskimos and the Arctic Indians. Pamphlets are being distributed advertising air tours of "igloo villages" along Alaska's arctic coastline and inland, and at least one airline has built hotels at key points on these tours.

T.W.A. and Pan American, who operate regular schedules to Alaska, are publicizing the "call to the Far North," printing brochures showing tourists laughing in company with pretty Eskimo girls. Canadian Pacific Air Lines' schedules to Fairbanks, in Central Alaska, offer Canadian holidaymakers opportunities of flying into the Arctic from Vancouver and Edmonton: fare $129 single or $242 return, flight time 11 hours. DC-4s are already heavily booked well ahead into June.

Jumping-off places for the new Alaska air tours are Fairbanks; Nome (the one-time gold-boom town on the frozen Bering Sea); and Anchorage, refuelling point for the new S.A.S. Tokio-Copenhagen (*via* Alaska) schedules.

Aviation developments within Alaska since the war have brought once-distant igloo villages within easy reach of Honolulu, Seattle, and Vancouver. Twelve aviation companies operate within Alaska. The largest of them, Wien Alaska Airlines, based at Fairbanks, is advertising six tourist-class air tours costing between $120 to a little under $200 for three days, using DC-3s. There is hardly an Eskimo or Arctic Indian village without an airstrip adequate for DC-3s, thanks largely to the U.S.A.F., whose activities include the maintenance of new radio, radar and meteorological stations.

*A Wien Norseman skiplane is loaded on the pack-ice just off Kotzebue. Dog teams provide the local surface transport.*

Thus areas that once took weeks of hard travel to reach are now included in two-day air tours. For example, among the Wien services for the tourist season starting in April are the following: Two-day tours (from Fairbanks) of the Eskimo settlements along the Alaskan coast opposite Siberia, price $120 (all prices include hotels, meals and ground transportation to and from airstrips); two-day tours of the Yukon River ($53); and a dramatic three-day trip northwards across 1,800 miles of mountains and frozen tundra to the Eskimo village at Barrow, the most northerly point of North America flanked by the Polar Ocean itself.

Fares include trips on husky-dog sledges to Eskimo sealing and whaling camps, with the chance of seeing drum dances, blanket-tossing, polar-bear hunts. Even five years ago such sights were almost beyond the reach of all but the hardiest, toughest travellers. Today, thanks to aviation development in Alaska, they are within four hours' flight of Fairbanks, with comfortable hotels (owned by the airlines) at even the most distant of the new tourist centres.

*Tourists at the Eskimo village of Kotzebue, a U.S.A.F. base in western Alaska overlooking the Bering Strait towards Russia, wait to board a Wien DC-3. The accompanying article describes how the airlines of Canada and the U.S.A. are developing Alaska's hitherto non-existent tourist trade. Wien, incidentally, are among the airlines reported to have ordered Safaris, the DC-3 replacement being built by Frye.*

More adventurous travellers can transfer at places like Kotzebue into such aircraft as Cessnas, Bellancas, Stinsons and Beavers (some owned by the airlines, others by bush-pilots), for flights to distant bear- and walrus-hunting camps—some of which are actually on the pack-ice. Fares depend of course on distance, with a minimum of around $25.

Coastal air tours include one from Nome northwards along frozen shores to an American-held polar island within three miles of a Soviet-held island by the same name—Diomede. Several airlines, including Cordoba Airways, are operating regular "fishing schedules" to waters where trout of 20 lb and 30 lb and salmon of up to 70 lb (repeat, 70 lb) are to be taken. These fishing tours operate from Anchorage, Juneau, Haines, Cordoba, Ketchikan, Nome, Seward and so on, with connections through Anchorage and with Seattle, and through Fairbanks with Vancouver (or Edmonton and central Canada and the United States).

There is no question that tourism in Alaska, with its romance, scenery and Eskimos, is destined to become big business, backed not only by airlines but by local commercial interests. Certainly the airlines do not consider Alaska beyond the reach of Europe and Australasia. At least one American airline is sending tourist pamphlets, decorated with pictures of Eskimo girls, to Britain, Scandinavia, Honolulu, and Sydney. It sees a day when developments will bring Alaska within the orbit of international tourism.

F.I.

*One of Wien's DC-3s at Nome—a centre of tourism, even though flanking the polar oceans. New air conditioned hotels await tourists.*

# HIGH-ENERGY FUELS

## *Some Possibilities and Probabilities*

By J. R. CRACKNELL

ALL aircraft fuels are materials from which energy can be released in a controlled manner to provide for propulsion. Nevertheless, different people make different demands on fuels, and so have varying criteria which govern their selection. The aero-engine designer, for example, wants a completely safe working fluid, which can be transformed efficiently into propulsive energy by the simplest, lightest and smallest device possible. An airframe designer, on the other hand, needs a material of high energy content per unit weight or volume, so that his airframe does not have to be loaded with excessive weights of fuel, nor swollen by vast tanks. The aircraft operator requires a cheap, readily available and safely handled substance.

This provides the following specification for the ideal fuel:—

(1) High energy content per unit weight (low-weight fuel).
(2) High energy content per unit volume (low-volume fuel).
(3) Easy handling.
(4) Cheapness.

Unfortunately these requirements tend to be mutually exclusive, as will be seen.

The first aviation fuels were hydrocarbons, and with comparatively minor modifications they still hold the field today. They have given good service, and appear to meet all the above requirements, until comparison is made of the first two specified properties with certain inorganic materials. But with such satisfactory fuels actually in being what is the incentive to change?

For the civilian operator there is at present none, but with air forces preparing to wage nuclear warfare for the most awful stakes, every last iota of efficiency and performance counts. One bomber which can with certainty penetrate the defences to deliver a nuclear weapon may, in some circumstances, suffice. With the increasing efficiency of miniaturized nuclear weapons the weight of the fuel load becomes a critical factor in performance. Conversely the defence must at all costs ensure that every bomber is intercepted well before it reaches the target, and that every interception will result in a certain kill.

Thus each is straining to the uttermost in the performance race, and in these circumstances can afford to pay a high price—almost any price—for a vital increase in performance, brought about by any means. Until now all but hydrocarbon fuels have been ruled out on economic grounds, and on the unavailability of other fuels in sufficient quantity to supply an air force. Today, with the greatly reduced number of bombers now needed to deliver a crippling blow, even the rarest and most expensive materials can and must be considered, if they will give the required performance.

A notable exception to the universal use of hydrocarbon fuels was the potent Messerschmitt Me 163 short-endurance interceptor of World War 2. This rocket-powered machine used entirely synthetic fuels, and did not employ the oxygen of the air. However, an aircraft whose engine picks up half of its fuel system (the oxygen) as it goes along does not need to carry as much fuel for a given range. For this reason it is proposed to confine this survey principally to the air-breathing engine.

Improved fuels affect aircraft performance in a number of ways. Below are set out some of the advantages achievable, but it should be borne in mind that many of them are mutually exclusive.

**For a given range:—**

Low-weight fuels allow
- Lower wing loading → Greater ceiling.
- Lower wing loading → Shorter take-off.
- Smaller wing—higher speed.
- Greater disposable load.

Low-volume fuels allow
- Slimmer airframe—greater speed.
- More space for equipment and weapons.

**For a given speed:—**

Low-weight fuels allow
- Lower wing-loading → Higher ceiling.
- Lower wing-loading → Shorter take-off.
- Greater range.
- Greater disposable load.

Low-volume fuels allow
- Greater range for given tankage.
- Slimmer aircraft—less power needed.
- More space for equipment and weapons.

**Performance Index.**—Of the four salient properties already mentioned as being required of a fuel, the easiest to measure are the first two. A number of possible fuels are shown in Fig. 1, with their heats of combustion per unit weight plotted on one axis, and per unit volume on the other. In the key these materials are listed in descending order of "performance index"; it is assumed that, in a hypothetical aircraft, weight-lifting capacity and volumetric capacity are equally scarce, and the index is arrived at by multiplying together the heat per unit weight and the heat per unit volume of a given fuel, and referring to kerosine, a currently used fuel, as unity.

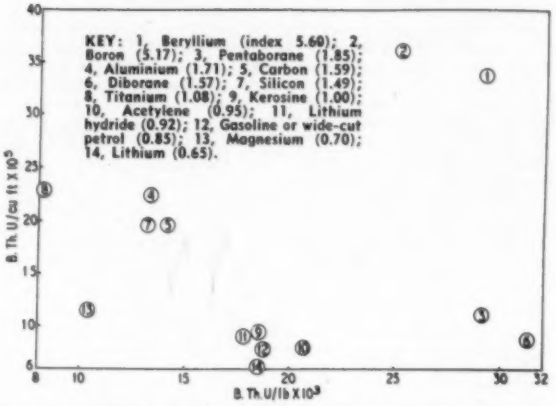

KEY: 1, Beryllium (index 5.60); 2, Boron (5.17); 3, Pentaborane (1.85); 4, Aluminium (1.71); 5, Carbon (1.59); 6, Diborane (1.57); 7, Silicon (1.49); 8, Titanium (1.08); 9, Kerosine (1.00); 10, Acetylene (0.95); 11, Lithium hydride (0.92); 12, Gasoline or wide-cut petrol (0.85); 13, Magnesium (0.70); 14, Lithium (0.65).
B. Th. U/cu ft X 10⁻³
B. Th. U/lb X 10⁻³
40
35
30
25
20
15
10
6
8
10
15
20
25
30
32

*Fig. 1. A plot of specific energies of certain possible fuels. The "index" quoted for each fuel is the product of heat per unit volume and heat per unit weight, kerosine being taken as unity.*

A number of interesting facts emerge from consideration of this diagram. Particularly notable are the excellence of beryllium and boron, and the very disappointing performance of such much-discussed fuels as magnesium. It is surprising to see how well the existing fuels stand up to comparison with all but the two first-mentioned fuels. Worthy of special mention is hydrogen, which is not shown. Hydrogen is supreme amongst fuels on considerations of heat-release per unit weight, but, even when liquefied, its density is extremely low. Moreover, the temperatures involved in keeping it liquefied are impossibly low, and the necessary pressures prohibitively high for aircraft use. The fact that its heat per unit weight is 2.8 times that of kerosine, and 1.8 times that of pentaborane commands attention, though its performance index is only 1.16. (It is interesting to note that the heats per unit weight of hydrogen-bearing fuels shown above, excepting the rather special case of acetylene, are closely in accord with the proportion by weight of hydrogen that they contain.)

**Unlikely Fuels.**—Detailed consideration of the various fuels shown in Fig. 1 will eliminate those unlikely to be used in practice.

*Beryllium* will probably have to be discounted on grounds of scarcity. In any case, the malignant toxicity of many of its compounds would have to be taken into consideration, as would the fact that the products of its combustion would attack components such as turbine blades.

*Aluminium* would probably have to be used as a slurry in approximately equal volumes of, say, kerosine. In that form its performance index would be only about 1.3. As aluminium is already inferior to the boranes there would be no incentive to use it as a slurry in these materials. In any case a slurry would be less easy to handle than kerosine, the products of combustion would erode metal parts, and the dry powder would be of lower net density than the slurries, even if means could be found to burn it as such. There seems little incentive to use aluminium as a fuel [see *Flight*, November 21, 1952].

*Carbon* possesses the advantage of burning to completely volatile, non-corrosive products, but would have to be used as a slurry to be of practical value. This would reduce its modest advantage over kerosine, and would not justify the extra handling difficulties. Again, the combustion of this involatile material would probably be slower than that of kerosine, so combustion chambers (and therefore engines) would have to be longer.

*Diborane.*—As several higher-molecular-weight boranes are now available, this material is at a grave disadvantage in handling characteristics and density. Diborane is self-igniting in air, will readily explode, reacts violently with moisture, is toxic, and is a gas at aircraft temperatures and pressures. These unpleasant characteristics are improved towards the higher-molecular-weight end of the borane series, so diborane is not likely to find a ready use.

The remaining materials of lower index, shown in the diagram, are readily dismissed on grounds of performance, erosive combustion products, and handling difficulties.

**Probable Fuels.**—This leaves a short list of two fuels—the boranes, and boron itself. These are now considered in detail.

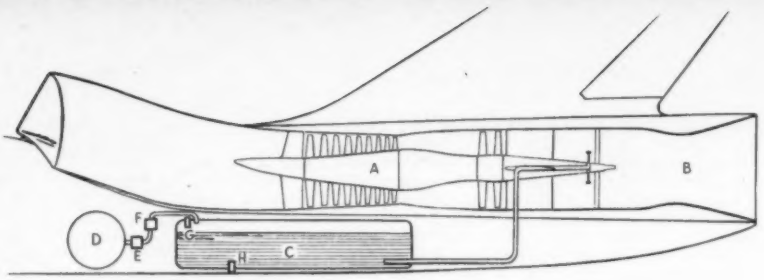



*Fig. 2. A schematic and hypothetical arrangement for a supersonic turbojet with afterburner. The basic engine is fitted with a conventional fuel system, but the afterburner is fed with corrosive high-energy fuel. A, turbojet; B, supersonic nozzle; C, high-energy afterburner (reheat) fuel; D, gas bottle; E, control valve; F, reducing valve; G, vent; H, pressure-fueller/drain.*

## HIGH-ENERGY FUELS . . .

*Boranes.*—Chemical considerations suggest that these are the supreme liquid fuels. Probably the only liquid-fuel system superior to borane/oxygen (hydrogen/oxygen apart) is borane/fluorine, but the thought of using and controlling such a system is awful. Of the boranes, pentaborane is probably the most convenient, being a mobile liquid freezing at −47 deg C and boiling at about +65 deg C, while possessing a high heat of combustion (though it is not quite as high as that of diborane). It is not spontaneously inflammable in cool air, but may explode in hot. On standing it can decompose into gaseous hydrogen and a higher borane which is solid and involatile but probably soluble in pentaborane. The latter will also decompose into solid boric acid and hydrogen gas in the presence of moisture—but only slowly, except at elevated temperatures (when it will explode).

It is toxic, and burns largely to boric oxide, which will erode, or build up on, turbine blades and other items in the gas-path, according to conditions. This means that this fuel cannot readily be burned upstream of a turbine in present-day gas turbines, and so would probably be restricted to use in ramjets or as an afterburner fuel for turbojets burning conventional hydrocarbon fuel.

The above are grave disadvantages, but the advantages are appreciable. It has a performance index of 1.85, being 1.6 times as good as kerosine on weight, and 1.17 times on volume. Also it is fairly easy to obtain, and its cost is not likely to be astronomic.

*Boron.*—This material is second only to diamond in hardness, and will be exceedingly abrasive. While it burns to the same cold products as do the boranes, it is a stable substance and does not burn below about 700 deg C. It will presumably have to be used as a slurry in an equal volume of kerosine, or perhaps pentaborane, with which it may well be stable.

The table below compares the properties of this final selection of fuels.

| Fuel | Performance Index | Heat/weight (Kerosine = 1) | Heat/volume (Kerosine = 1) |
|---|---|---|---|
| Boron ... ... | 5.17 | 1.36 | 3.80 |
| Boron-pentaborane | 3.50 | 1.40 | 2.50 |
| Boron-Kerosine ... | 3.10 | 1.26 | 2.40 |
| Pentaborane ... | 1.85 | 1.60 | 1.17 |

From the above table it will be seen that the boron fuels are likely to be used where volume is the prime consideration, and pentaborane where weight is the first consideration. Of the boron fuels the kerosine slurry is likely to be selected, as it is but slightly inferior to the pentaborane mixture, and yet is without the severe handling difficulties of the latter.

**Fuel Handling.**—Methods for overcoming the handling difficulties of these fuels must be devised. We should not be too despondent about this, for the chemical industry has, in general, found that whether a material can be handled or not depends largely on what the customer is prepared to pay. As evidence of this one can cite the recent case of "high test" peroxide (H.T.P.) and the German war-time development of fluorine-containing incendiary bombs. Further, we should not forget that our present Avgas has a flash-point of about −30 deg F, and Avtag as low as −20 deg F.

It is pertinent to consider what sort of combustion systems will be able to use these fuels. As all of the fuels considered will erode or build up accretions upon metal parts, their use in present gas turbines, under present operating conditions is ruled out completely. The following alternatives therefore present themselves:—

(1) Use in conventional gas turbines of limited working life.
(2) Use in a ramjet.
(3) Use in the afterburner of a conventional gas turbine.

The first alternative might be acceptable in the conditions that have been outlined above, where the cost is a relatively minor consideration in comparison with efficacy. Presumably components other than the turbine would have a reasonably long life, and it might be possible to devise techniques for reconditioning or replacing that part. The reported greater speed of combustion of these fuels would presumably make possible shorter combustion chambers and therefore a lighter engine.

Use in a ramjet would only commend itself for very fast aircraft (Mach 2.5 or more), and even then alternative means would doubtless be required to accelerate the aircraft up to high supersonic speeds at which the main powerplant could become effective.

Use in an afterburner would be the easiest way of using the new fuels. Nevertheless it would not improve the overall performance of the aircraft very much, and it would impose an undesirable inflexibility into the fuelling arrangements, in that it would be necessary to decide in advance just how much afterburner power was to be used. Afterburners have not won acceptance for subsonic bomber aircraft, for what is the use of escaping enemy pursuit only to fall into the sea for lack of fuel? However, in a properly designed supersonic bomber it does carry the primary advantage of allowing a very high-speed "dash" to, from, or near to the target.

**Pumping and Storage.**—Next to be considered is the pumping of the fuel. There can be little doubt that, from the point of view of fuel handling, the most desirable method of pumping would be by pressurizing the tanks by an inert gas such as nitrogen. This has certain disadvantages; wells would be required at the bottom of tanks in thin wings; any surging of the fuel might result in the delivery of nitrogen instead of fuel, with the resultant exhaustion of the "pumping" gas; and there would be the weight penalty of the storage vessels for the gas. Above all, perhaps, would be the fact that all the tanks would have to be stressed to accept the high gas pressure (Fig. 2).

For the borane fuels, centrifugal or positive-displacement pumps, with very efficient glands, should be possible. But, with the slurries, wear on such components might well prove an extremely difficult problem to overcome.

A further problem with slurries is that steps should be taken to keep them homogenous and prevented from settling out into solid and liquid. As a result of the widely varying temperatures experienced in aircraft, suspending or thickening agents are not likely to give a free-flowing composition at all times, and the reduction of the liquid component to a minimum would give a fluid of poor flow and high scour, even if it reduced settlement. Some form of vibrator, such as an ultrasonic transducer, might keep the boron in suspension, but is unlikely to be beloved of the airframe designer.

The evolution of hydrogen from the boranes would demand non-return relief valves for the tanks, and the absence of steel parts from the fuel system might be necessary due to the phenomenon of hydrogen embrittlement. Also, in the case of the boranes, rubbers and certain other organic materials in tanks and fuel systems would be suspect on grounds of fuel instability.

The hazards of the boron/kerosine slurries would be almost entirely those of abrasion and settlement, but in ground storage and filling, the boranes would demand as much care as in the air. All tanks would have to be entirely free from air and moisture, and air would have to be excluded during transfer operations, and new hose materials found.

**Manufacture.**—As to manufacture there should be no great difficulties, as most of the methods are well worked out. The U.S.A. are particularly well blessed with suitable raw materials, an attribute they share with Tibet! While the cost of both boranes and boron can be expected to be reduced as production experience grows, they can never be expected to be as cheap as present fuels.

**Conclusions.**—The conclusions, then, are these. Appreciable gains are obtainable from the use of inorganic fuels, but great resources will have to be deployed if their shortcomings are to be overcome, in order to make them into workable fuel systems. This can doubtless be achieved, but the efforts required to do so should not be underrated. Suffice it to say that tremendous programmes of research into new aircraft fuels are under way in America—and, one imagines, in this country also.

## A POSTSCRIPT . . . . . by the Technical Editor

THE above account is a valuable contribution towards making the pros and cons of high-energy chemical fuels known to a much wider public. It is necessarily a theoretical treatment of the subject. Virtually nothing has been said of British programmes in this field, for such programmes, if they exist, would inevitably be of military interest and therefore subject to security classification.

One of the few British pronouncements on actual work being done was contained in a news-letter sent last month to stockholders of Borax (Holdings), Ltd., by the chairman of the company, Mr. D. Abel Smith. In an outline of the research programmes upon which the American and British companies in this group are about to embark he said that "substantial results" could safely be expected from the potentialities of both the organic and

## HIGH-ENERGY FUELS . . .

inorganic compounds of boron. He confirmed that, as far as special propellants for high-performance weapons were concerned, the value of both diborane and pentaborane seemed fully established, and that several large American companies already planned for their large-scale production.

There is a widespread tendency among American engineers to describe high-energy fuels as "zip fuels." There seems much justification in choosing a terse name of this type, provided everyone understands what it means. At first hearing, the term "chemical fuel" seems ridiculous, since *all* fuels are chemical within the meaning of the term. In practice, of course, the word "chemical" is used to signify "non-nuclear."

Several current production ramjets in the U.S.A. are being extensively tested on zip fuels, particularly where these engines are associated with guided missiles. Both North American's SM-64 Navaho cruise-type bombardment missile and Boeing's IM-99 Bomarc intercepter are being intensively evaluated with such fuels, and certain aspects of their performance are being substantially improved by these means. In addition, the Triton, another winged cruise-type bombardment weapon—developed for the U.S. Navy from the Johns Hopkins University's "Bumblebee" programme—has been designed for high-energy fuel for its twin ramjets from the outset. An almost identical fuel is expected to be employed in future production models of Talos, a surface-to-air missile—also a Bumblebee offspring—used by both the U.S. Army and Air Force.

The American chemical industry is rapidly expanding its facilities for producing boron-based fuels. One can cite the case of the Stauffer Chemical Company, whose plant at Niagara Falls is now delivering boron trichloride in "tank-car" quantity, ten times greater than last year. Boron trichloride is a useful starting point in the manufacture of many high-energy fuels and missile propellants. Some of it is being used for making ethyl borane, a high-energy/hydrocarbon fluid reported to have been fed to a turbojet.

At a pilot plant in Laurel, Maryland, the Metalectro Corporation, a subsidiary of U.S. Industrial Chemicals, are producing limited quantities of trimethyl aluminium. This fluid is highly inflammable and ignites spontaneously upon contact with air. It is believed to have applications as a catalyst and in other functions in the chemical industry, and is already on test as an ignition fluid and fuel for turbojets and ramjets.

The largest single programme for a piloted aircraft powered by high-energy fuels is the U.S. Air Force Weapons System 110A. The specification of the WS-110A calls for a supersonic bomber with dash-performance of approximately Mach 2. Contracts for bombers to this important specification have been let to Boeing and North American.

It is widely held that both manufacturers envisage using conventional hydrocarbon fuel for turbojet cruise propulsion, with high-energy fuel retained for use in the afterburner at full thrust. Although considerable interest is still being shown in lithium-based fuels, it now seems almost certain that the final choice for both the WS-110A machines is pentaborane. The accepted U.S.A.F. figure for pentaborane heat-release is 29,127 B.Th.U./lb. It is also pointed out that it weighs roughly 38 lb/cu ft compared was 42 for aviation petrol and 51.2 for kerosine. Pentaborane is considered particularly important in large long-range aircraft, where weight is more important than bulk.

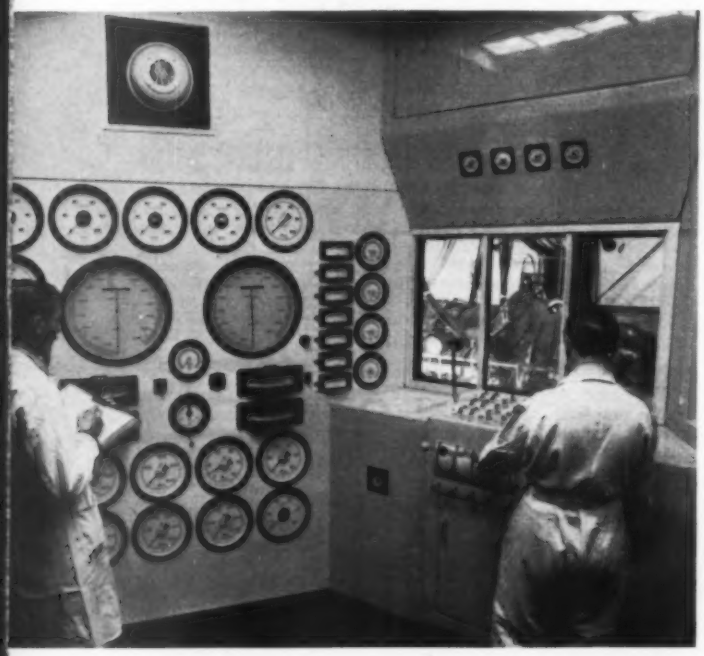
Naturally, any future chemically-fuelled bomber to WS-110A must be a competitor to the nuclear-powered aircraft being produced to specification WS-125A. The latter programme has recently been "stretched out"; in fact, the Defense Secretary, Mr. Charles Wilson, stated last month that the WS-125A projects ought to be kept in the preliminary design stage until some big technical break-throughs could be achieved. Such an opinion might not have been expressed by Mr. Wilson had there not been promise of early success with the high-energy-fuel aircraft.

Actually both Boeing and North American seem to be relatively happy with their WS-110A responsibilities. Their success is likely not only to draw funds away from the nuclear aircraft but also to initiate re-evaluation of certain programmes for bomber-defence missile systems.

## I.A.S. NAVAL AVIATION MEETING

THIS summer—from August 5 to 10—the Institute of the Aeronautical Sciences is to hold a new fixture, to be known as the National Naval Aviation Meeting. The announcement says that the meeting "will be broad in scope, with discussions centering on the rôle and detailed requirements of naval aviation, including water- and carrier-based aircraft and operations; missiles; helicopters; and S.T.O.L. and V.T.O.L. aircraft."

The meeting, which will take place at San Diego, will conclude with a flying demonstration of some of the latest types of aircraft in service with the United States Navy.



***POWER AND PRECISION**: Last week we described development of the D.H. Gyron turbojet to 25,000 lb thrust, and this view of the control room of a Gyron test-bed, with its array of bold instruments, was taken recently at Hatfield. Among firms who supplied equipment for the installation were Detuners, H. J. W. Cullum, Minneapolis-Honeywell-Brown, Barnet Instruments, Rotameter, Rellumit and Tannoy.*

## INFLATABLE ROTOR BLADES

DEVELOPMENT of inflatable fabric rotor blades for helicopters and convertiplanes is being undertaken by the Goodyear Tire and Rubber Co. and Goodyear Aircraft under a contract recently announced by the U.S. Navy Bureau of Aeronautics.

So far the programme has entailed demonstrations of the lift characteristics of the Airmat fabric blades, as they are called, fitted to one-man helicopters.

Main structural members of these blades are two layers of high-strength cloth woven simultaneously with "drop" threads interconnecting the layers. Length of drop threads determines the inflated contour of the blade section. After weaving, the basic cloths are coated, and cover layers are applied to give pressure-tight surfaces of the desired strength.

To date very few precise details have been made public, because the research is still in its initial stages; but it is believed blades of this type can be fabricated far more quickly and at lower cost than conventional types.

## R.Ae.S. ASSOCIATE EXAMINATIONS

THE pass list for the Royal Aeronautical Society Associate Fellowship examinations, held last December, has been issued. Names of the successful candidates, under both the old and the revised syllabus, are as follows: —

**Part I.**—K. L. Arora (India), J. C. K. Baerselman, A. Beedle, C. L. Bhatara (India), D. H. Chester, T. H. F. Delap, R. F. M. Drake, D. W. Evans, W. J. Everett, Flt. Cdt. R. Feakes, N. D. Holdsworth, F/L. B. Husain (India), D. J. Lloyd Lewis, P. J. Marsh (Canada), F. Minhas (India), Flt. Cdt. R. F. Mundy, D. S. C. Paine, Tilak Raj (India), M. K. Ramamurthy (India), Cpl. P. D. Sadana (India), P/O. D. S. Sarma (India), P. G. Simpkins, J. Strymowicz, J. F. Teague (Australia), Flt. Cdt. R. L. Thomas, Flt. Cdt. M. Yunus.

**Part II** (old syllabus).—C. A. Bainbridge, A. Beedle, R. M. Blunt, K. Broddle, E. A. Coates, L. W. Coultous, M. T. Darwood, J. H. Davies, B. V. Davis (Australia), L. F. M. De Swart, R. F. M. Drake, D. W. Evans, F/O. M. Farmer, J. Farrington, D. Gortmans, H. Greene, A. J. Harland, J. O. Hill, W. H. S. Hoy, D. O. Lewis, J. G. Lodge, P/O. R. A. Nicol, K. G. F. Noble, J. Pickles, F. M. Rands, R. S. Skulsky (Texas), S. Smith, O. J. Stevenson (Australia), J. E. Wingate.

**Part II** (revised syllabus).—A. Finaz, V. S. Hedge (India), F. Minhas (India), R. H. Platt.

*The Polish BZ-4 Zuk four-seat helicopter, powered with a 320 h.p. WN-4 engine. Work on this machine began in 1953 and four production variants are now foreseen.*

# AIRCRAFT INTELLIGENCE

### Great Britain

*Hawker Hunter F.6.* Almost alone among modern fighters, the Hawker Hunter has not suffered from obvious redesign of the wing. Not a change has hitherto been introduced which is superficially obvious, but current F.6 Hunters from Kingston have a kinked, or dog-tooth, leading edge. The modification is not vital to the efficiency of the aircraft and it is most unlikely that it will be retroactively applied to machines already built.

### U.S.A.

*Convair F-102A.* In this supersonic interceptor the braking parachute is housed in a box whose doors, when open, act as air brakes. Since the beginning of the year a new design of door has been used, rather larger than previously, and extending well aft of the rudder trailing edge. The 102 has no official name, but "Lancer" was submitted for consideration by the Department of the Air Force in Washington following a name-finding contest at George A.F.B.

*Mixed-power Fighters.* Some of the latest types of U.S. Navy fighter have such high speed that their zoom ceiling—trading kinetic energy for altitude—is well above the height limit to which their engines can function; in fact, machines like the F8U and F11F-1F (the latter has flown level at 72,000ft) can reach altitudes considerably above their engine flame-out limits. Rocket motors are the obvious answer, and an F8U Crusader and an FJ-4 Fury are now both flying from Patuxent River with controllable rocket motors. This might be a field for the British de Havilland Spectre.

### Canada

*Avro Aircraft CF-100 Mk 6.* This designation identifies the latest Avro CF-100 long-range all-weather fighter. It incorporates the increased-span wings and horizontal tail introduced on the Mk 5 and has provision for carrying four Canadian-built Sperry Sparrow II air-to-air missiles. The latter missile was adopted when Canada's own Velvet Glove programme was discontinued.

### France

*Hurel Dubois HD.34.* The first HD.34 intended for the Institut Géographique National made its first flight at Villacoublay on February 26. Fitted with two 1,500 h.p. Wright Cyclone engines it differs from the HD.32 transport in having a closed observation station in the nose, a retractable nose undercarriage unit and special provision for photographic equipment. Eight of these aircraft are on order, and the first should be delivered during the second half of this year—several months ahead of schedule.

*S.E.210 Caravelle.* The following progress report on the Caravelle has been received from a French source: "Having completed its test flights at the CEV, on January 18, the S.E.210 Caravelle 02 has since this date been in the hands of the decorators who are busy preparing it for its presentation trip to America. The cabin is fitted out with grey carpets and its light grey ceiling will be lighted by two fluorescent galleries. The 52 seats are separated into thirteen rows, four across, and are the colour of Provence tile. Each row of seats will be provided with a loudspeaker placed next to the aeration orifices, behind a gilt grid. The soundproof and exceptional accoustical qualities of the Caravelle will be exploited to the maximum, since the music of Mozart will be played during the voyages. The separation panels between the cabin, the front hold and the washrooms and wardrobes, will provide excellent surfaces for masterpieces of art to be hung on each side of the doors. Some of these canvases will depict France and others the countries visited. Thus, the Caravelle, which is a representative of French technique in foreign lands, will also be a symbol of good taste and art. The completely equipped plane will resume its flights on March 11 and will arrive at Orly around March 20."

# PROPHECY IN AERONAUTICS

## *A Study in Perspectives*

**Part I**

**By A. V. CLEAVER, F.R.Ae.S.**

THE importance of reasonably accurate prophecy in such a rapidly developing subject as aeronautics hardly calls for emphasis. Did not Sir Miles Thomas himself, while chairman of B.O.A.C., protest against the more exuberant ploys in what he called "the merry game of brochuremanship"? If the lessons of the past were soberly applied to the prediction of the probable future, perhaps fewer aircraft firms would claim to be able to achieve more difficult tasks in the next five years than the easier ones on which they had spent the last ten; at least they might have a more realistic appreciation of what would be involved in doing so.

On a broader canvas, such exercises in controlled prediction might prevent the world at large being taken a little less by surprise when confronted by the impact on everyone's lives of new technical developments—aviation as a whole being a case in point, atomic energy an even more recent one, and space-flight (which is looming up to concern the next few generations) yet another.

Firm conclusions are hard to draw, beyond the fact that in the past most aeronautical prophets usually seem to have been wrong most of the time. However, a fair generalization might be that whereas on the one hand they have often tended towards optimism in their assessment of what could be done within five to ten years, using relatively modest extrapolations of the particular existing techniques and devices with which they already considered themselves familiar, on the other hand their pessimism about the possibilities of the next ten to fifty years has often verged on the ludicrous. Thus, one sometimes meets people today who believe that the regular operation of supersonic airliners could begin by 1965, but who nevertheless express considerable scepticism, often with great wit and confidence, about the possibility of men landing on the moon by the end of the century.

Aviation certainly began in just this atmosphere of long-term scepticism, not to say derision. In 1896, Major Baden-Powell, then Secretary of the Aeronautical Society (not yet Royal) wrote to the great physicist, Lord Kelvin, inviting him to become a member. In reply, he received a letter stating "I am afraid I am not in the flight for 'aerial navigation'. . . . I have not the smallest molecule of faith in aerial navigation other than ballooning, or of expectation of good results from any of the trials we hear of . . ."

Kelvin was not alone in his opinion, which of course was the currently respectable and expert one. On the other side of the Atlantic, Simon Newcomb, another physicist of lesser but still very considerable eminence, wrote at about the same time: "The demonstration that no possible combination of known substances, known forms of machinery and known forms of force, can be united in a practicable machine by which men shall fly long distances through the air, seems to the writer as complete as it is possible for the demonstration of any physical fact to be."

This, it should be noted, was less than a decade before the Wrights flew, using principles which had been enunciated, and even largely demonstrated, by Cayley, Henson and Stringfellow, and many other pioneers, long before Newcomb wrote his extremely rash prediction.

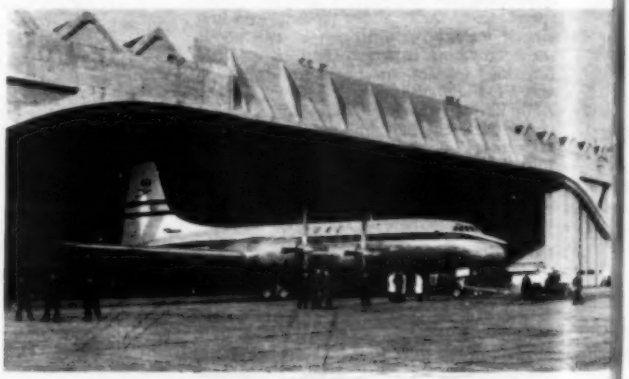
The more enlightened textbooks of the future must surely record "Kitty Hawk, 1903," as one of the great events in the history of mankind. Even nearer to it than Newcomb—on January 1, 1901, to be precise—the forerunner of the present *News Chronicle* canvassed opinions on likely developments in the new twentieth century. Its editor observed: "The century which closed last night was in many respects the most wonderful in the world's history," and went on to ask: "Is the twentieth century destined to achieve similar triumphs over nature and equal the discoveries of her secrets?" In particular, he asked an engineer, a Mr. Worby Beaumont, "Shall we fly?" This pundit replied: "Yes, before the next hundred years have gone, in all likelihood. But the present generation will *not*. And no practical engineer would devote himself to the problem now."

Well, this was all just a few years before Kitty Hawk; but only a few years *after* the Wrights had flown, the famous American scientist William H. Pickering was still writing in this vein:—

> "The popular mind often pictures gigantic flying machines speeding across the Atlantic and carrying innumerable passengers in a way analogous to our modern steamships. In spite of our warning, it seems safe to say that such ideas must be wholly visionary, and even if a machine could get across with one or two passengers the expense would be prohibitive to any but the capitalist who could own his own yacht. Another popular fallacy is to expect enormous speed to be obtained. It must be remembered that the resistance of the air increases as the square of the speed, and the work as the cube. If, with 30 h.p. we can now attain a speed of 40 m.p.h., then in order to reach a speed of 100 m.p.h. we must use a motor capable of furnishing 470 h.p. This figure may be somewhat diminished by changes in the shape of the machine and the angle of the wings but it is clear that with our present devices there is no hope of competing for racing speed with either our locomotives or our automobiles."

It would appear that the "popular mind" is often more perceptive than the expert's; when it is a question of being able to see the wood for the trees, intuition and a certain shrewdness of judgment are often better aids than a mass of detailed knowledge. Whether this need be so is a point to which we shall return later; but that it very often *has* been so is beyond dispute. Newcomb and Pickering and Kelvin might be explained (but hardly excused), because they were really venturing opinions on a subject outside their own specialized fields: hardly excused, because that should have made them doubly cautious before expressing such views, since a negative prediction, by its very nature, is always the riskiest to the prophet's reputation. However, this explanation is in any case far from a complete one, because by no means all of those who failed to see how aviation would develop were to be found outside the aeronautical movement.

Probably the best example of this, from the early days, is the

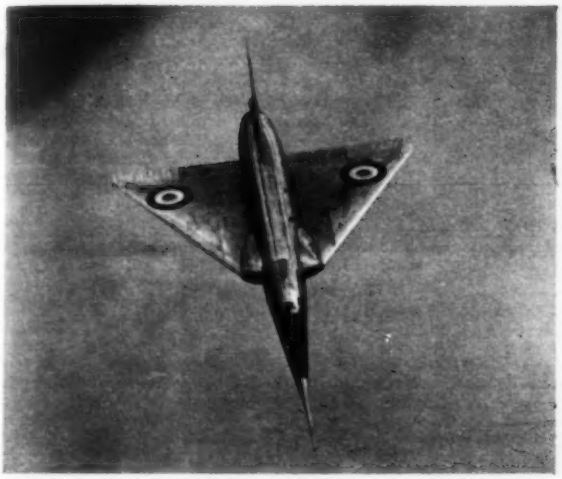


*Even the pioneer glider experimentalist Octave Chanute was pessimistic in his prophecies; he forecast that the chief use for flying machines would be for sport, as they would be "small and cheaply housed." Anything large and not-so-cheaply housed was by inference discounted: it would "have no commercial value for the regular transportation of freight or passengers, as loads would be too small . . ."*

*"The popular mind often pictures gigantic flying machines speeding across the Atlantic and carrying innumerable passengers . . . such ideas must be wholly visionary . . ."—pronouncement made by an American scientist, William Pickering, after the Wrights had flown.*

following pronouncement by Octave Chanute, made at roughly the same time as Pickering's. It is certainly a surprising one, because whereas Pickering was a leading astronomer and scientist, Chanute was not only an eminent American engineer but also a life-long enthusiast and experimenter in the field of heavier-than-air flight; he made important personal contributions, especially with gliders, and was the mentor of the Wright brothers. Nevertheless, just listen to him, in the first decade of this century:—

"The question occurs as to what is to be the probable use to man of these new modes of transit. We can already answer that they will have no commercial value for the regular transportation of freight or passengers, as the useful loads will be too small and the trips too uncertain and irregular. We may, however, discuss their merits for sport and for war purposes, and leave it to the future to show whether new utilities are to be found beyond those of explorations of otherwise inaccessible regions. . . . Apparently the chief use for flying machines will be in sport. Their advantages will be their cheapness, as the cost need not exceed 5,000 dollars; also the superiority of their speed, which is now 40 m.p.h. and presently will be increased to 50 m.p.h. or more. Moreover, they are small and cheaply housed. Their disadvantages are that their useful loads will always be small, as their own weight increases faster than their total carrying capacity."

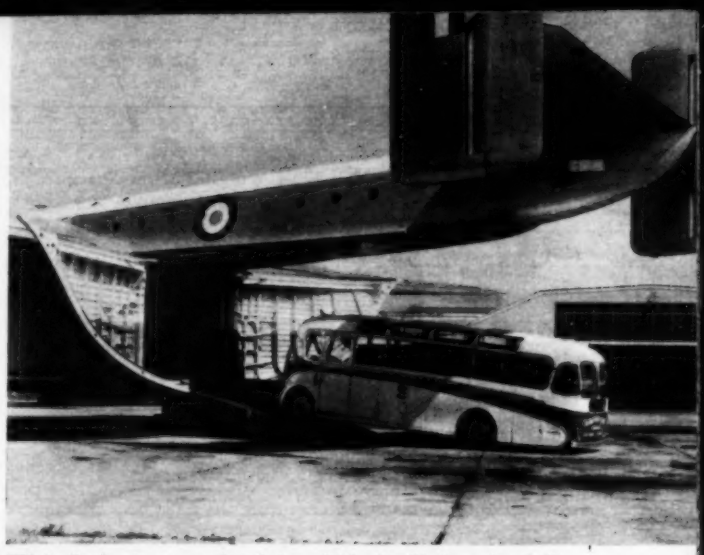


*Pickering again: "Another popular fallacy is to expect enormous speed to be obtained . . . in order to reach a speed of 100 m.p.h. we must use a motor capable of furnishing 470 h.p. This figure may be somewhat diminished by changes in the shape . . . and the angle of the wings."*

All this suggests that there is at least a case for undertaking serious attempts at more successful prophecy of the future course of technological development, over several decades, and in particular, of its effects on society. Parallels to the preceding examples of hopelessly inaccurate aeronautical predictions could be provided from other fields. Herz's doubt that the electro-magnetic radiations he had discovered could ever be used for wireless telegraphy, and Rutherford's pooh-poohing the suggestion that useful power might one day be obtained from "splitting the atom" (after Cockcraft and Walton had first achieved this result artificially, using laboratory techniques which involved putting in more energy than came out)—both of these are well-known and often-quoted examples. However, most readers of this journal are mainly concerned with aeronautics, so let us confine ourselves to that subject. None better could be chosen to illustrate the trends under examination.

A very brave try at well-considered prophecy of the sort here advocated appeared just over a quarter of a century ago, in the form of a book entitled *The World, the Air, and the Future*, written by Commander Sir Charles Dennistoun Burney. I quite vividly remember first reading this, and being deeply impressed by it, as an enthusiastically air-minded schoolboy. More recently, I picked up a copy in the remnant box at Blackwell's famous bookshop in Oxford, and so came to read it again. I was equally impressed on this second reading, though, on many counts, for quite different reasons. It must be admitted that, in most respects, the book has not worn very well, though in others it has, even to the extent of still appearing ahead of its time; but even when its arguments and predictions seem, by hindsight, incongruous to the point of ridicule, they remain worthy of present re-examination. Such a process is full of interest and (inevitably) some amusement; as in the earlier examples quoted, there are valuable lessons to be learned, and a great deal of food for thought.

Sir Dennistoun Burney, of course, first attained fame as the inventor of the paravane device for mine-sweeping, in the First



*"Their disadvantages are that their useful load will always be small as their own weight increases faster than their total carrying capacity" —Chanute, circa 1907.*

World War. Later he became an M.P., notable for his interest in matters concerning aviation and the Empire; he was also responsible for an early rear-engined streamlined car, eventually put on the market by the Crossley Co. Above all, however, he was perhaps the main prime mover behind the British commercial airship programme between the wars, and responsible for the private-enterprise contender—the R.100, built in competition with the ill-fated R.101 of the Government Airship Works at Cardington.

On political and sociological matters, Sir Dennistoun's conclusions have, on the whole, stood the test of time better than his technical predictions. I think it is fair to say this, for while some of the detailed statements made now appear almost grotesque, others have a distinctly modern ring, and yet others belong at least to the realm of the might-have-been. At any rate, there can be little doubt that Burney was one of the first to realize the full significance of aviation as a world force, in both the military and civil spheres. Back in 1929, he preached the prime importance of air power in military preparedness, and rightly said that this was best achieved by encouraging a vigorous and healthy civil aviation industry, both of manufacturers and operators. He maintained that London's "sea-centrality" among the world's major nations would give our capital city a permanent advantage enduring into the air age, conferred by geography and not by history.

His views on the effectiveness of aerial bombardment needed the later invention of nuclear weapons to become entirely valid, for his assessment of poison gas and "conventional" bombing was the typically exaggerated one of most early enthusiasts for air-power. It is also interesting to find him advocating two "unified services"—one comprising the Royal Navy and the main body of the Royal Air Force, with all strategic air power and home defence, and the other the Army with its own tactical air arm.

There is a distinctly nostalgic flavour about most of Sir Dennistoun's patriotic references to the British Commonwealth, which it was still quite respectable to call the British Empire at the time he wrote. (How far away those times are is also indicated by a reference to "the huge annual sum of £120 million" for the British Defence Budget; now, it amounts to about twelve times as much —or perhaps "only" three or four times, after allowing for inflation.)

Thus, we are asked: "May we not hope, then, that we are on the threshold of a new era in the history of British Imperialism, and that the advent of the air age will see the inauguration of a bold and comprehensive policy of Empire development worthy of the glorious traditions of our race?" It is further suggested that: "The Imperial Conference will then become an annual affair, and what is more, the way will be paved for the setting up of a Commonwealth Parliament which shall be in permanent session like the League of Nations at Geneva," and again that: "Our vision is of the Empire inaugurating a period of world-culture that will be specifically British in character."

It is fashionable now to sneer at such sentiments, but one wonders whether Sir Dennistoun's dream really was as impracticable and undesirable as all that; also (Mr. Macmillan notwithstanding) whether he was not right when he said that if our country did not "devote all her energies to the work of Empire development and consolidation" then "she will be out-weighted and outdistanced, and must inevitably sink to the rank of a second-class Power."

In any case, Sir Dennistoun's philosophy was far from being that of mere Victorian jingoism. His real vision was of a world so shrunk by rapid air transport that its nations would tend to coalesce into larger units, just as the United States underwent

## PROPHECY IN AERONAUTICS . . .

such a process under the earlier pressures of rail transport. A United States of Europe should also evolve in time, and a much more closely integrated British Commonwealth, made possible by air communications, was simply the particular unit closest to Burney's heart. (Has a great opportunity been lost?)

He asked "Will the development of long-distance aircraft . . . mean, perhaps, that the idea of American 'isolation' will have to be discarded as impracticable, like the 'splendid isolation' idea that inspired British foreign policy at the end of last century?" and predicted that "A progressive Chinese Republic, with a fully awakened national consciousness, will dominate the Far East." He realized that "as things are at present, it is difficult for Great Britain to extricate herself altogether from the European tangle" and warned that "It is both narrow and foolish for this country to regard America's claim to share with her the naval supremacy of the world *on an equal footing* as a hostile challenge." The italics are mine, but if these last two quotations sound quaint and old-fashioned today, only twenty-eight years later, consider how modern are the following ones from the same book: "A means of transport that will help to unify the Atlantic peoples will also help to unify the human race" and: "the harmonious development of Anglo-American relations is the cornerstone of World Peace."

Sir Dennistoun Burney clearly believed, then, that the ultimate goal should be the final association of all large geographical units into a World State—"Indeed, air power practically demands a World State for its free and systematic development, and from an airman's standpoint the national divisions of mankind are so many irritating obstacles in the path of progress . . . an elaborate system of air communications throughout the world implies at least a partial victory of the international principle." On the question of the irritating obstacles which still make that victory only very partial, he also made a number of pertinent and still highly topical comments.

In fact, one feels that our progress has been on the Gilbertian principle of one step forward, three steps back, ever since he wrote in 1929 that: "the greatest obstacle to the development of the air is the spirit of nationalism . . . nationalism in its narrow sense is an anachronism in the modern world." How true it still is that "the whole purpose of air travel will be stultified if aircraft are to be victimized by the obstructive paraphernalia that the territorial divisions of mankind have put in the way of free travel and intercourse between peoples; if . . . the air traveller may be subjected to the usual routine of passport revision, luggage inspection, purse-prying, and all the other delays and inconveniences that waste the time and patience . . . and make the passage from one State to another such a difficult business at the present time. To make air travel worthwhile, all these petty obstacles must be done away with."

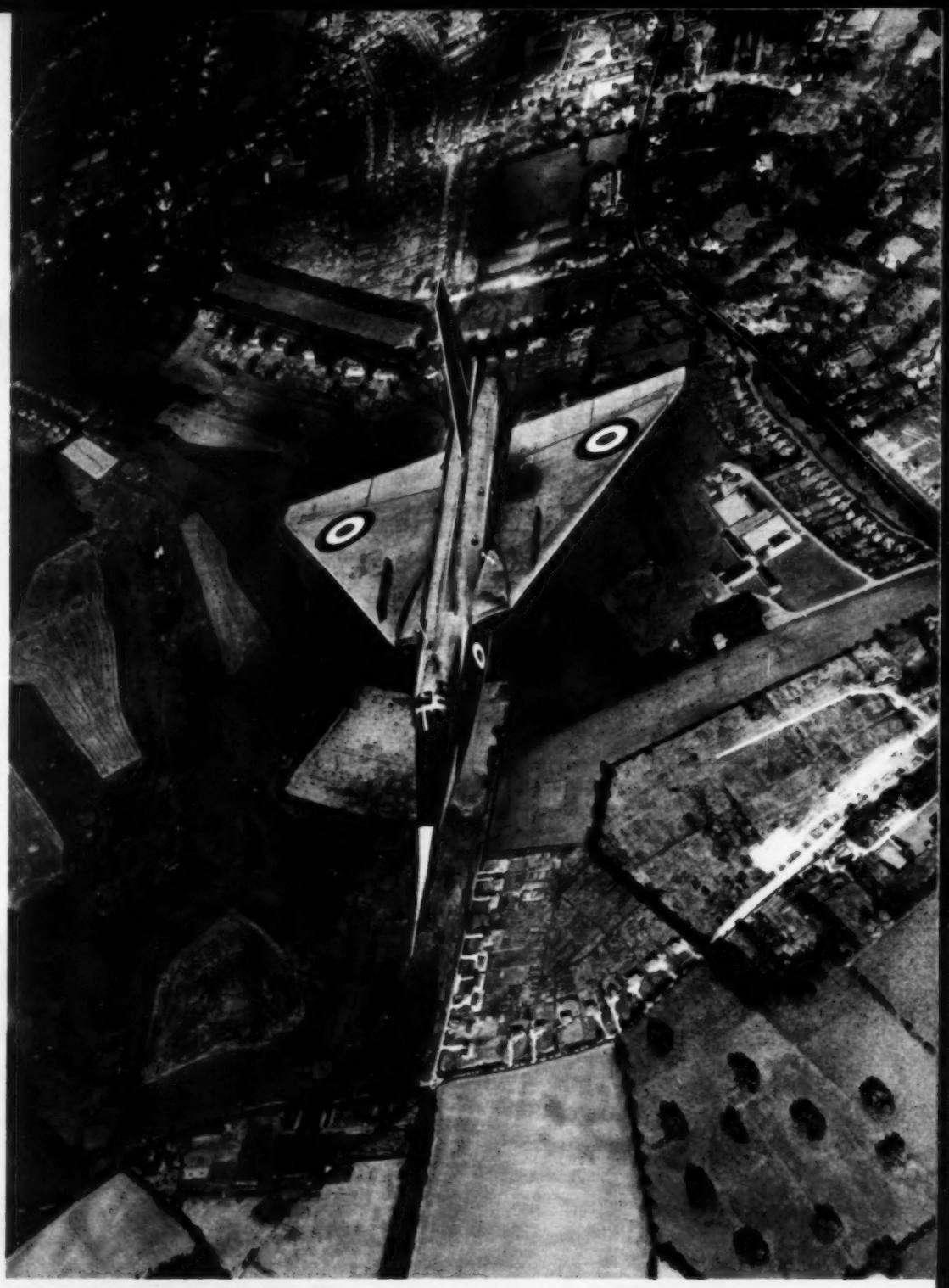
Burney also emphasized (A.R.B. and C.A.A., please note) the "desirability of reaching some international agreement as soon as possible in regard to what are known as 'Airworthiness Certificates.'" His own suggestion for solving this still controversial problem was interesting, for he advocated that the authorities issuing such certification should not be national bodies, but administered by the League of Nations. In fact, he went further than this, and wrote: "I propose that civil flying should, as far as possible, be put under the control of the League of Nations . . . all or a large proportion of civil aerodromes should be ceded or turned over to the League . . . in much the same way as Mussolini has recently ceded a small area of territory to the Pope. A traveller flying about Europe would, in effect, never leave League of Nations territory . . . unless he wished."

So much for Sir Dennistoun Burney's views, now just under thirty years old, on the social effects of aeronautical developments; however, a great deal of his book was concerned with their technical aspects. As the publishers' blurb on the dust-jacket stated: "His conclusions for both heavier and lighter-than-air craft are remarkable not only for the possibilities but for the limitations discovered in size, range, speed and load."

Some of them were remarkable indeed, at least by the hindsight of 1957, as we shall see in the concluding part of this article.

## THE NAME OF A SAINT LIVES ON IN DUBLIN'S FAIR CITY

*Massing clouds sweep in from the Irish Sea, but Viscount 707 St. Laurence O'Toole stands serene and splendid under the blue. One of four 707s in Aer Lingus service, and soon to be joined by three 808s, this Viscount bears the name of a great and good son of Dublin. Archbishop of the city from 1162 until his death in 1180, he was canonized in 1225. In Irish his name is rendered as Lorcán Ua Tuathail.*

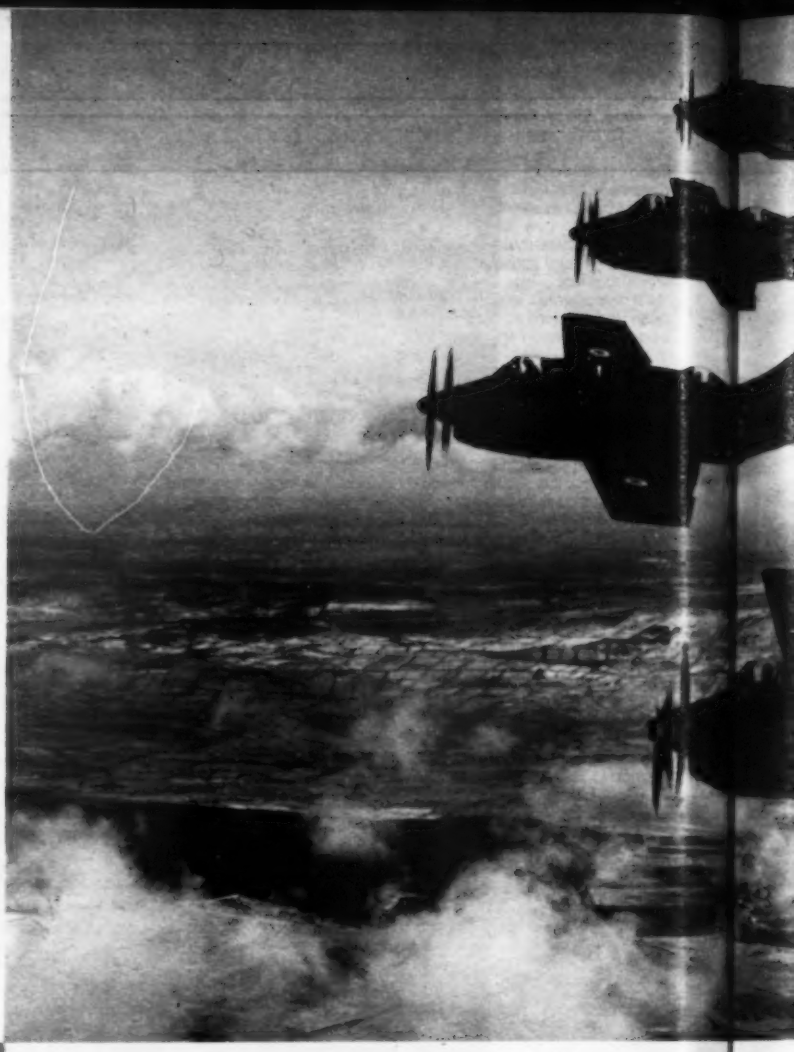


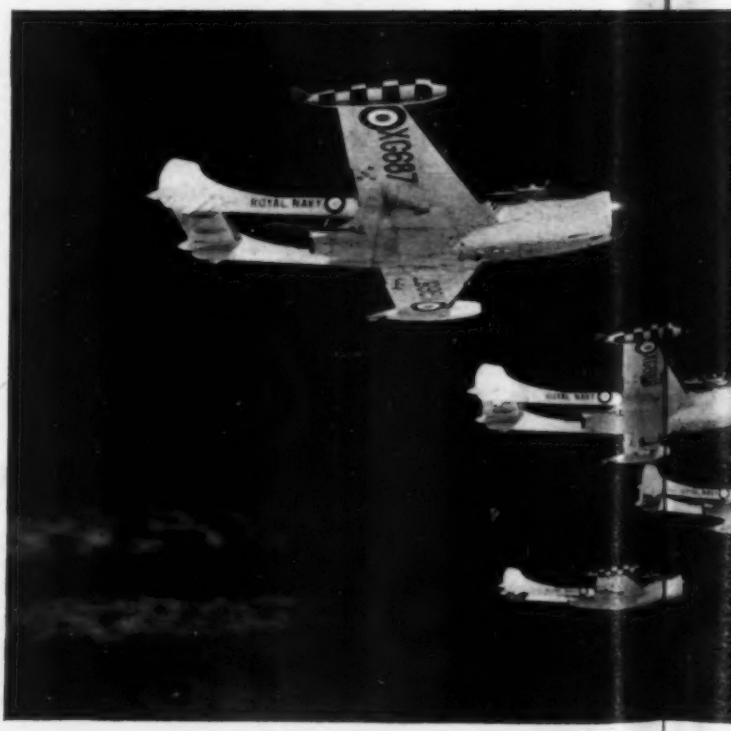
# ONE YEAR SUPREME

A LITTLE over a year ago, on March 10, 1956, a Fairey F.D.2 supersonic research aircraft, powered with a Rolls-Royce Avon turbojet, secured the world's air speed record of 1,132 m.p.h. It was flown by Mr. Peter Twiss, a test pilot of the Fairey Aviation Co., Ltd. In conjunction with Mr. R. L. Lickley, the company's technical director and chief engineer, Mr. Twiss recently described the development of the aircraft before the Royal Aeronautical Society, in a paper abstracted in our issues of February 22 and March 1. Notwithstanding good-natured American protestations that the U.S.A. could easily retrieve the record with the Lockheed F-104 fighter, Twiss's performance still stands supreme in the annals of the Fédération Aéronautique Internationale. We print this hitherto unpublished *Flight* photograph, showing the record-holder over Southern England, as a tribute to a splendid—and enduring—British achievement.

# NAVAL TYPES

THESE new *Flight* photographs, by L. W. McLaren, are offered as a foretaste of our special Fleet Air Arm issue, to appear next week (March 22). For many weeks past, in company with Kenneth Owen, of our editorial staff, McLaren has been visiting Royal Naval Air Stations. His pictures will be presented in the forthcoming enlarged number together with some lively impressions by artist Gordon Horner, who accompanied Owen on a visit to carriers in the Mediterranean. To secure their material our representatives flew in Vampire and Meteor jet trainers, Gannet turboprop anti-submarine aircraft, Firefly Trainers, Westland and Hiller helicopters—and a B.E.A. Viscount.





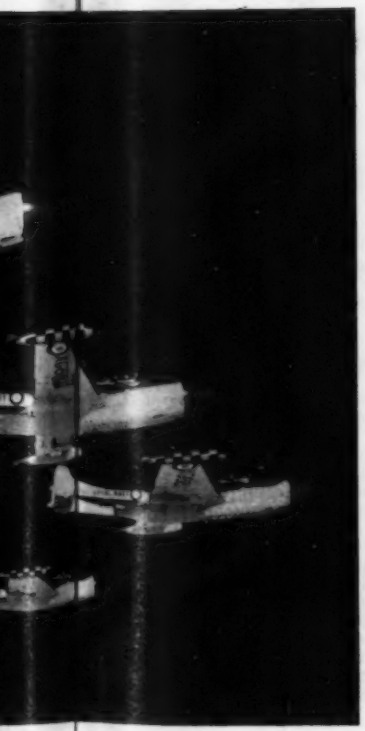
## "FLIGHT" photographs

*(Left) Fairey Gannet A.S.1 anti-submarine aircraft (Armstrong Siddeley Double Mamba twin-turboprops) of No. 820 Squadron. The snowy hills are in Northern Ireland.*

*(Lower left) A Hawker Sea Hawk F.B.5 fighter/bomber (Rolls-Royce Nene turbojet) of No. 806 Squadron. The aircraft is doing a MADDL (mirror airfield dummy deck landing).*

*(Lower centre) de Havilland Sea Venom FAW.22 all-weather fighters (de Havilland Ghost turbojets) of No. 894 Squadron.*

*(Below) A Douglas Skyraider AEW.1 airborne early-warning aircraft (Wright R-3350 Cyclone piston engine) of No. 849 Squadron. St. Michael's Mount, Cornwall, is below.*



# DHC-4 Caribou

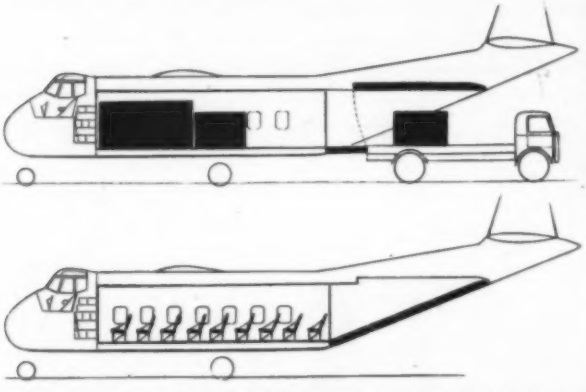
## *An Important New Transport in the D.H. Canada Tradition*

FOR two years or more it has been known that the de Havilland Canadian company, of Toronto, have been designing a new transport. Dubbed in the past as the "Twin Otter," the de Havilland DHC-4 Caribou was last week officially made known to the world in a joint statement by the Canadian firm by the parent de Havilland company at Hatfield.

At the same time it was confirmed that the aircraft has already (as foreshadowed in previous issues of *Flight*) been ordered. Five have been purchased—at a cost equivalent to about £1m—by the U.S. Army, who, as the satisfied owners of several hundred Beavers and Otters, are D.H. Canada's best customer.

The de Havilland Caribou is related to the Otter just as that aircraft is to the Beaver—it carries about twice the load for about the same performance. From the point of view of gross weight (24,000 lb) and payload (about 7,000 lb), the Caribou is in the DC-3 class: in its field performance it is a true S.T.O.L. aeroplane.

It will be able to use 800ft strips—actual take-off run, fully loaded, is 450ft in zero wind or 330ft in a 10 m.p.h. wind. This performance is made possible by wing-tip to wing-tip double-slotted flaps (the outer trailing portions of which act as ailerons) hinged to a 95ft-span wing with an aspect ratio of 10. The Caribou's most attractive physical feature is undoubtedly its very large rear door, permitting easy loading (by built-in winch and ramp) and rapid supply dropping.



*These views shows how the Caribou's spacious interior lends itself to freight, loaded at truck-bed height through a big rear door, and to 28 passengers. Other layouts accommodate 28 fully equipped troops in wall-type seats, or 14 stretchers plus ten seats.*

The aircraft will start life with piston engines, although it appears to lend itself to the installation of two Rolls-Royce Darts. There will be a choice of two types of piston engine of comparable power: Pratt and Whitney double-bank R-2000s (the 1,450 h.p. engine of the DC-4), or Wright R-1820s, the 1,500 h.p. engine of the Grumman Tracker/Trader.

The *raison d'être* of the Caribou, as defined by de Havilland, is for an aeroplane "to serve as an Army vehicle designed to provide rapid mobility for troops, equipment and supplies in forward battle areas, and as a commercial transport intended to offer low-cost [18.7 cents per ton statute mile] transportation of passengers and cargo in undeveloped areas."

There seems little doubt that the Caribou owes much in its conception to the requirements of the United States Army, which (state D.H.) "has extended active assistance in recent years to a number of design and research projects having as their objective the further development of S.T.O.L. and V.T.O.L. . . . Interest in these types has been intensified by the threat of atomic warfare. It is no longer considered safe to concentrate large bodies of ground forces in any one area and the new concept is one of small units widely dispersed and having great mobility. To this end the United States Army in recent years has concentrated on the acquisition of S.T.O.L. and V.T.O.L. aircraft with the object of providing rapid transportation for its ground forces within combat zones."

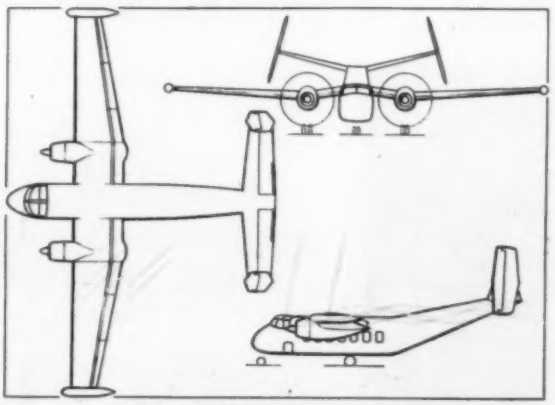
*A transport which will get 28 fully armed troops airborne in 100 yards: an impression of D.H. Canada's new S.T.O.L. aircraft, the first of which will fly in the summer of 1958.*

**DE HAVILLAND DHC-4 CARIBOU**

**Dimensions:** Span, 95ft; wing area, 912 sq ft; aspect ratio, 10; height, 27ft 8in; cabin volume, 1,052 cu ft; floor dimensions, 23ft by 6ft 1½in; max. cabin width, 6ft 11in; cabin height, 7ft 3in; floor height from ground, 3ft 6in; total length, 63ft 8in.

**Performance** (P. & W. R-2000 D5a at 24,000 lb gross weight in I.S.A.): Take-off ground run (short field technique), 450ft in zero wind, 330ft in 10 m.p.h. head-wind; take-off distance to clear 50ft obstacle, 800ft in zero wind, 650ft in 10 m.p.h. wind; landing round-run (dry concrete), 300ft in zero wind, 330ft in 10 m.p.h. wind; total landing distance over 50ft obstacle, 700ft in zero wind, 550ft in 10 m.p.h. wind; climb-gradient after take-off, 18 per cent; *en route* rate of climb at normal rated power (5,000ft), 1,580 ft/min or 380 ft/min on one engine; service ceiling, 26,000ft or 13,000ft on one engine; cruising speed at 51 per cent power at 7,500ft, 185 m.p.h.; stalling speed, landing flaps, 59 m.p.h.; payload-range (freighter), 7,320 lb for 200 st. miles, 6,700 lb for 400 st. miles, 6,000 lb for 600 st. miles—all including fuel allowances for climb, descent, landing and 45 minutes' cruising reserve.

**Weights:** Empty, 14,500 lb; radio, 200 lb; fuel and oil for 500 miles with reserves, 2,575 lb; crew of two, 340 lb; payload for 500 miles (freighter), 6,385 lb; total design gross weight, 24,000 lb; additional weight allowances for de-icing and for passenger furnishings are respectively 315 lb and "up to 1,500 lb."



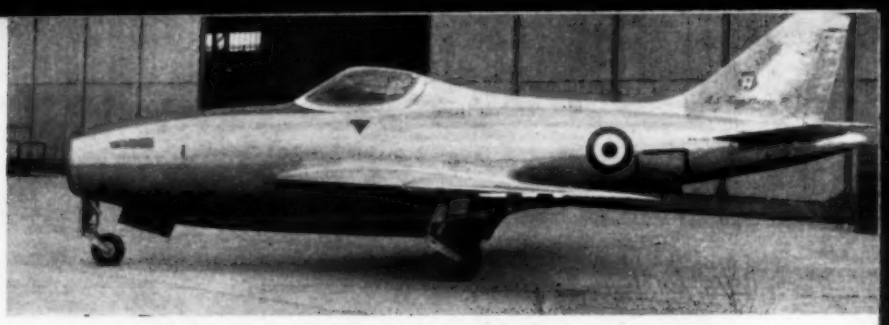
## SOUTH UIST AND ST. KILDA

ESTABLISHMENT of a guided-missile range in the Outer Hebrides is being received with mixed feelings by the local population.

Last June a Scottish Office announcement stated "the general area of the range-head would be a strip of land of some 1,700 acres on South Uist near Loch Bee. A good deal of this land can continue in its present use . . . although some 300 acres would have to be fenced off for launching points and technical buildings. . . ." The range is intended to be a centre for proving and indoctrination trials with weapons for the Army and R.A.F.

A tracking station is to be established on the lonely island group of St. Kilda, some 90 miles out in the Atlantic from South Uist (a distance which gives a clue to the performance of the weapons involved). Two radar tracking sites and a helicopter station will be built some 1,000ft above the sea on the island of Hirta; an advance party of R.A.F. and Army will land there next month and 40 to 50 men will be permanently stationed on the island.

# Sagittario II Light Fighter



*Supersonic in a dive, the little Aerfer Sagittario is powered by a Rolls-Royce Derwent 9, and carries much British-made equipment.*

DEVELOPMENT of the Italian Aerfer Sagittario II powered by Rolls-Royce Derwent 9 is proceeding, and the constructors claim that it is probably the first aircraft in the world to have easily exceeded Mach 1 in a dive with only 3,600 lb of thrust.

The Sagittario II, which is at present being tested by Lt-Col. Franchini, is designed as a day intercepter and close-support aircraft. It is reported to carry two "rapid-fire 0.30 cannon" and has attachments for the standard NATO range of air-to-ground weapons. Wing sweep is 45 deg, and the nose-mounting of the Derwent allows easy inspection and ample volume for fuel in the fuselage. Reported to be effective well into the compressibility zone, the ailerons are statically and dynamically balanced and hydraulically boosted with Fairey Hydroboosters. There is manual reversion. Plain flaps, reaching from fuselage to aileron, are hydraulically actuated, as also are undercarriage, air-brakes and horizontal tail. The air-brakes are mechanically interconnected.

The under-fuselage is covered with an air-cooled sheet of stainless steel to prevent damage from the efflux, which is vented close under the fuselage, level with the wing trailing edge. Hydraulically controlled, the tailplane can be directly linked to the stick to provide "all flying" control. The undercarriage is a retractable Dowty unit with Liquid springs; wheels and brakes are by Dunlop. Martin-Baker have provided their Mk 4 lightweight, fully-automatic ejection seat with hood-jettisoning and seat-firing controlled by the blind-handle or alternative seat-pan firing trigger. Normalair have co-operated with an air-conditioning and pressurization system giving combat and normal cruise pressure settings. A pressure-breathing oxygen system is fitted.

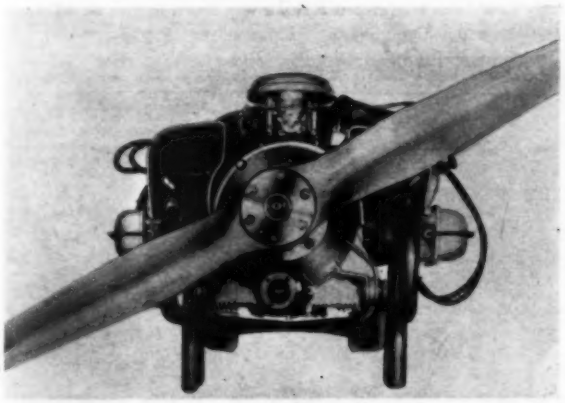
Communications are assured by Marelli Type 2 ARC, 12-channel V.H.F. set. The cockpit canopy is manually opened, assisted by bungees. The electrical system is supplied by a 24/28 V generator of 1,500 W capacity. Smiths Aircraft Instruments have supplied the r.p.m. counter for the Derwent 9. The total internal capacity of 1,200 litres of kerosine is carried in four rubber tanks inside the fuselage.

**Leading data:** Span, 31ft 2in; length, 24ft 7in; wing area, 156 sq ft; empty weight, 4,950 lb; maximum weight, 7,170 lb; wing loading, 49.3 lb/sq ft; take-off run, 2,130ft; time to 39,400ft, 10 min; service ceiling, 46,000ft; maximum level speed, over 625 m.p.h.

## FIRST POST-WAR GERMAN AERO ENGINE

A LIGHT aircraft (65 h.p.) version of the German Porsche flat-four car engine has successfully passed, at Brunswick, its 150-hour test to B.C.A.R. Initial overhaul life is 600 hours.

A reduction gear ensures that the full 65 h.p. is delivered at a propeller speed of only 1,900 r.p.m. The standard Bosch generato (160 W, 12 V) supplies sufficient current for lighting, instruments and communications equipment. An electric starter is a standard fitting, and a choice of two fully screened ignition systems is available—either dual magneto or dual coil. A dry-sump lubrication system is fed by a tank of 5.3 U.S. quarts capacity. The dual down-draught carburettor allows simple aerobatics for aircraft in the normal and utility classifications.



*The Porsche flat four, air-cooled, 65 h.p. light aircraft engine.*

Porsche, who are marketing the engine, predict maximum speeds of up to 135 m.p.h. (depending on the type of aircraft) and fuel consumptions of 5.6 U.S. gal/hr at take-off power and 4.1 U.S. gal/hr at the 50 h.p. cruising setting. A high-efficiency exhaust muffler and carburettor air filter and de-icing system are standard, together with a hot-air connection for cabin heating.

A second version of the Porsche aero engine has dual carburettors and a cooling fan, and is designed for buried installation. A reduction ratio of 1.74:1 ensures increased take-off power at 2,600 propeller r.p.m.

A third, simplified, powerplant gives 50 h.p. at 3,300 r.p.m. and weighs only 154 lb. It has no starter, but retains dual ignition and carburettor heating system. Porsche world service will, it is stated, be available for these engines.

All three models use 80-octane fuel. The first two have a dry weight of 192 lb and, with cowling, starter, generator, muffler and ignition screening, weigh 232 lb.

## ALL-WEATHER HELICOPTERING

THE library of the Royal Aeronautical Society was packed to capacity on Friday last, when two excellent papers on the subject of all-weather helicopter operation were presented by Mr. P. A. Hearne, D.C.Ae., helicopter project engineer, B.E.A., and 1st/Off. J. W. Reid, D.F.C., one of the pilots on the B.E.A. Helicopter Unit. Both the technical and operational aspects of the problem were discussed and the lecturers outlined those steps that would have to be taken now if the next generation of larger transport helicopters, at present in the design stage, were to be utilized to their full potentiality. Three short films showed a series of night landing trials with a specially developed high-intensity lighting pattern, in the form of a "Cross of Lorraine," and other trials carried out with an adaptation of a marine harbour course beacon system for the final approach stage.

In the words of the chairman, W/C. R. A. C. Brie, here was a realistic approach to the problems involved without any fanciful theorizing. From the discussion which followed the two lectures, it appeared that military experience had been similar to that of B.E.A. and the conclusion reached was that satisfactory operation of helicopters in conditions of 150-yard visibility and 150ft cloud-base would be quite practicable with existing equipment provided that there was adequate development work. We hope to publish a more detailed account of the papers and the discussion in a subsequent issue.

**Footnote:** Since our "Forthcoming Events" column (p. 347) went to press, the Helicopter Association have notified that their meeting originally announced for April 8 will take place on April 5.

## FINLAND'S GNATS

MANUFACTURE of the Folland Gnat Mk 1 by Valmet OY for the Finnish Air Force will total 20 aircraft. It is expected that Folland will supply sets of parts, with tooling and other support facilities to assist the Finnish company, in addition to delivering twelve complete Gnat Mk 1s. Earlier references to this order have appeared in *Flight* of November 9, 1956, and January 4, 1957.

*After arrival by road from the R.A.M.C. Field Training School at Mytchett, Hants, the weatherbeaten fuselage of Dakota KN550 awaits its rehabilitation in the Ringway Airport, Manchester, hangar of Eagle Aircraft Services.*

# CINDERELLA TRANSFORMATION

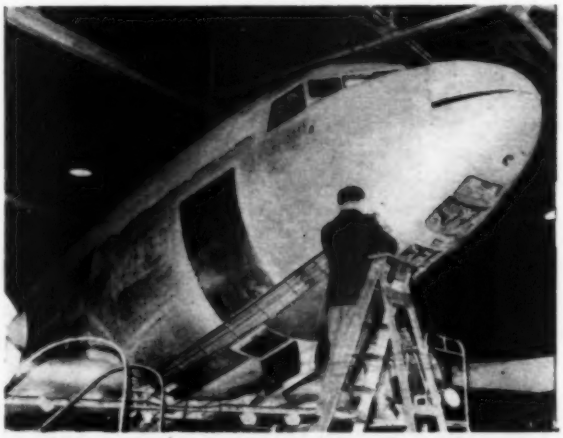
## *A Dakota for Aden Airways—and its Unusual History*

ONE aeroplane in its life may play many parts, and this is especially true of the Dakota, which in the past fifteen years has developed a well-deserved reputation for versatility. Some of the chequered careers among that valiant band of maids-of-all-work may be epitomized by the recent transformation at Ringway and Blackbushe of a Dakota whose history can only be described—forgivably, perhaps, since the pantomime season is only just over—as a Cinderella operation with an equally happy ending.

This Dakota bears the registration G-AOJI and this week she was flown from Eagle Aircraft Services, Ltd., at Blackbushe, to Aden, to join the fleet of Aden Airways, an associate of B.O.A.C., who are now the Dakota's owners. It would be tempting fate to attempt a forecast of her future there, and one will not try; but it is merely recording history to trace the steps—albeit falteringly, for information is not complete—by which G-AOJI came to this happy ending after having stood on the ground as a wingless fuselage for five-and-a-half years.

In R.A.F. service this Dakota bore the serial number KN550, and it may well be that many ex-Dakota crews both in and outside the R.A.F. have this number somewhere in their log-books. It was in May 1945 that KN550 came to this country from No. 45 Group in Canada. She languished at Kemble, Glos, until September that year, when she was flown off to the Far East. The records indicate that in May 1946 she was in India; and in July the following year she returned to this country and went to No. 12 M.U. at Kirkbride. There is a gap then in the Dakota's history until March 1949, when she was delivered to Oakington. While based at that Cambridgeshire R.A.F. station, KN550 went on the strength of No. 30 Squadron and was flown on the Berlin Airlift.

Operation Plainfare, the R.A.F. part of the Berlin Airlift, came to an end on September 23, 1949; and in that month KN550 was sent to No. 22 M.U. at Silloth—whether by road or by air the records do not indicate. It is possible that she stayed there inactive for the next ten months; for in June 1950 she was struck off R.A.F. charge and put in the spares category.



*A stage in reconstruction (right), showing how all electric wiring had to be renewed and hydraulic and de-icing supply lines checked; and (below) the "transformed" Dakota—wearing her Aden Airways livery and re-registered as G-AOJI—at Blackbushe Airport shortly before leaving for Aden and new duties as a civil airliner.*

This might have been the end of her story: a once hard-working Lease-Lend Dakota parked at an M.U. and being gradually diminished by the need for spares for other Lease-Lend aircraft. But matters took an unusual turn before the end of that year.

It happened that the Army Field Training School at Mytchett, near Farnborough, Hants, wanted a fuselage for the ground-training of young R.A.M.C. officers and N.C.O.s. They were to be given demonstrations of loading equipment and casualties and an opportunity of familiarizing themselves with the fittings for the carriage of stretchers. The fuselage which came to Mytchett on an R.A.F. Queen Mary—knocking down, one is told, several walls and fences in the narrow lanes surrounding the F.T.S.—was that of KN550.

Some mystery surrounds the whereabouts of the Dakota prior to her arrival (in dismembered form) at Mytchett. Colonel J. H. J. Crosse, O.B.E., who was Commandant of the F.T.S. at the time, says that—from hearsay—they understood that the Dakota "had recently crashed in Southern England and was a write-off." This may have been true; for if KN550 was flown to No. 22 M.U. as a serviceable aircraft, she might have done some flying either from there or at another unit to which she may have been sent during those nine months and, if so, might have had a mishap. Alternatively, the fuselage which arrived at Mytchett may have been specially dismantled for the purpose; or might have been all that was left of KN550 after cannibalization for spares. Humiliating though this posting may have seemed for a once-serviceable aircraft, it was not, however, the end of things for KN550; though her Cinderella-like transformation was to be a long time—approximately five-and-a-half years—in coming, thus giving it the right taste of refreshing unexpectedness.

At Mytchett the aircraft was on free loan from the Air Ministry to the War Office for an indefinite period. She was painted white and the side of the fuselage lettered with the words "Field Training School R.A.M.C." Many courses of officers and N.C.O.s must have learned to load casualties through that ever-open door, and

## CINDERELLA TRANSFORMATION . . .

they went on doing so until the time came when the duty of loading ambulance aircraft was taken over by R.A.F. casualty-evacuation personnel. The War Office then quite naturally decided that the fuselage was redundant and requested the Air Ministry to remove it.

There now enters into this story a touch of the macabre, for it is said that the Dakota (still on its wheels) ran away while it was being moved, prior to its complete removal from Mytchett, and ended its run with undercarriage in a tank ditch and nose resting ignominiously on the edge. There it was pathetically visible from the main Southampton-London railway line. Such a story, even if apocryphal—it has not been possible to prove it—adds even more point to this Cinderella's subsequent transformation scene.

In this case (though it might be tactless to carry the pantomime analogy too far) the Good Fairy was Eagle Aircraft Services, Ltd. For when the Air Ministry put up what was left of KN550 for sale by competitive tender, E.A.S. bought it. They then transported this very dilapidated fuselage and centre section by road up to their premises at Ringway Airport, Manchester; and their problem—no easy one, by any stretch of imagination—was then to get a C. of A. and transform what was once a flyable aeroplane into a saleable proposition.

Eagle set about this task with remarkable promptitude, for within about three weeks of getting KN550 to Manchester, they had arranged for its sale to B.O.A.C., on behalf of Aden Airways, as a completed aeroplane with a full 12 months' C. of A. Rebuilding it, however, proved a much more laborious and lengthy task; for, after nearly six years' untended exposure to the wind and weather, much of KN550's fuselage and centre section was unserviceable—and certainly nothing unserviceable escaped the eagle eyes of A.R.B. and B.O.A.C. inspectors keeping a close watch on all the work being done.

There was, inevitably, a tremendous amount of corrosion to be cleaned up. The fin attachment frames had been broken by incorrect haulage. All the white paint had to be removed. Fortunately, the fuel tanks were serviceable; but the obtaining of spares to replace unserviceable items and new parts to make the aircraft complete presented a big problem to Mr. R. Clacher, who has been in charge of production, and Mr. C. W. Axten, who is responsible for inspection of all work done, in the Eagle hangar at Ringway. They got a port wing from B.E.A., and the starboard one came from S.A.S. at Copenhagen; so G-AOJI—to give this demobilized Dakota her civilian title—will fly over the Arabian deserts in somewhat mongrel fashion. New tyres and engines, of course, had to be obtained; and the fuselage has been given a complete new skin from aft of the wing roots, both above and below. All electrical wiring was renewed and hydraulic, de-icing, fuel and oil supply lines checked, most of them being renewed. The front cockpit equipment was still reasonably complete, but had to be replanned to meet Aden Airways' requirements. All the passenger accommodation has had to be fitted from scratch to B.O.A.C./Aden Airways standards; and understandably the complicated work—virtually a rebuilding—has taken something over twelve months' patient effort to complete. Its achievement is a fine piece of work by Eagle Aircraft Services, Ltd.

Now, however, G-AOJI has been completed and wears her new white and blue colours with Aden Airways' double Speedbird insignia, under which she now starts a life of civilian passenger carrying. Who would have thought, when the aircraft left Canada in 1945, that nearly twelve years later she would find her way out to Southern Arabia in B.O.A.C. service? And how many of her future passengers will realize that the aircraft in whose tastefully appointed cabin they are comfortably sipping their coffee or orange juice above the desert sands was once a neglected and weatherbeaten fuselage used for the ground training of R.A.M.C. personnel near the military town of Aldershot? Perhaps Aden Airways—in view of her unusual history—might call G-AOJI *Cinderella*. Or maybe—like the rest of the Aden fleet—the new aircraft will remain discreetly anonymous. H.W.

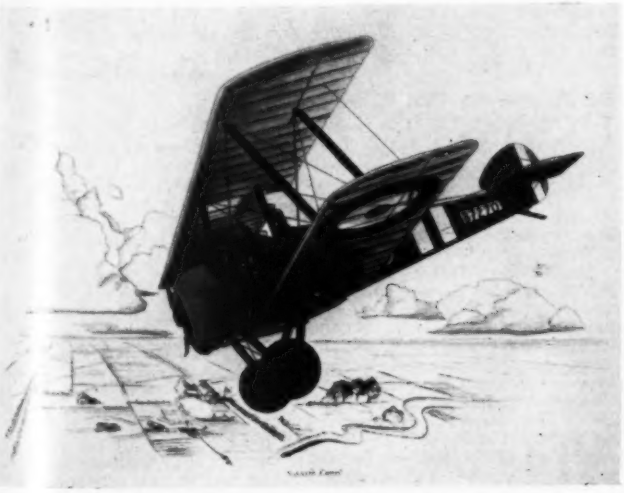
## SPEEDING U.S.A.F. PRODUCTION

LAST week the U.S. Defense Department announced five guiding factors which, it was hoped, will reduce the overall period between the issue of a requirement for military aircraft and their delivery to user squadrons.

The factors are: better long-range planning for new weapons; energetic tapping of all sources of ideas for new weapons; Service Secretaries and Chiefs of Staff to pay close attention to new weapons earlier in the development cycle to achieve correct priority and financial support; each new programme to be supervised by an experienced military officer who will remain in his post for more than three years; and simplification in contract procedures.

## NORTH AMERICAN IN EUROPE

A EUROPEAN office—in Geneva—is to be opened by North American Aviation, Inc., under the charge of Robert J. Clark, who will be stationed at the Hotel du Rhône until permanent offices are ready. Mr. Clark, who joined the company in 1943, has for the past three years been their Washington staff's co-ordinator with the U.S. Navy Bureau of Aeronautics.



## HARVARD CONVERSION

A CONVERSION of the ubiquitous North American T-6 or SNJ Harvard, incorporating a tricycle undercarriage and other refinements, is scheduled to fly this month. The new machine, known as the Super-6, is the product of the Erle L. Bacon Corporation of Santa Monica, U.S.A., and is expected to complete C.A.A. flight tests in April.

The conversion has been developed for sale primarily to foreign air forces, several of which are stated to have indicated serious interest in the project. After fifteen years' service, the retirement of the T-6 from the U.S. Services was recently announced.

The principal new features of the Super-6 are the tricycle landing gear, modernized power package with jet stacks and augmentor cooling, one-piece canopy, new lightweight Goodyear wheels, modernized cockpit and instrument panel, reduction of 4ft in span, wingtip fuel pods, and a general "cleaning-up" of the airframe to reduce weight and drag. An increase in cruising speed of 30 m.p.h. and a 20 per cent greater cruising range are estimated. The original main fuel tanks in the centre section have been removed to accommodate the main landing gear, but the total fuel capacity is increased.

## BRITAIN FROM THE AIR

UNDER the title *From the Pilot's Seat*, Chapman and Hall published in 1950 a book in which were reproduced over a hundred low-altitude oblique photographs of features of scenic and architectural interest in the British Isles. Finely printed on art paper, the collection was in many ways a remarkable one, with an informative commentary by Mr. Cyril E. Murrell—managing director of Aero Pictorial, Ltd., of Redhill Aerodrome, Surrey, who own the copyright of the photographs. Some remaining copies of the book were acquired by Aero Pictorial and are being retailed at 12s 6d—half the original published price. Aero Pictorial style themselves "artists in aerial photography," and if the illustrations in this book are typical of their work the claim is not an exaggerated one.

***COLOURED DRAWINGS** of historic aircraft (measuring 8in × 10in, plus a white border) are now available, price 3s 6d each, from Gordon Storey, 9 Cecil Court, Charing Cross Road, London, W.C.2. The reproduction here is indicative of their style. Already in the series are the Camel, Nieuport 17, Spad, Bristol Fighter, D.H.4, R.E.8, F.E.2B, S.E.5A, Pup, Fokker Triplane, Fokker D.VII and Albatross. In preparation are similar pictures of the Zero, Me 109, Spitfire, Hurricane, Tomahawk, Fw 190, Ju 87 and Me 110.*

# Correspondence

*The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns; the names and addresses of the writers, not for publication in detail, must in all cases accompany letters.*

### Ensigns—and Refugee Airliners

WITH reference to your remark about the Focke-Wulf Condor G-AGAY in Mr. Peter Moss's Ensign article (February 15, page 206), I can confirm that this aircraft was ex-Danish.

It was delivered to Det Danske Luftfartselskab on July 4, 1938, as OY-DAM, the c/n being 2894. Named *Dania*, it was used mainly on the route Copenhagen - Hamburg - London. After the outbreak of the war, the British terminal was moved from Croydon to Shoreham, and when Denmark was occupied by Germany on April 9, 1940, the aircraft was at the last-mentioned aerodrome. It was then taken over by the Secretary of State for Air and registered G-AGAY. In 1941, it was impressed as DX177 and in August the same year it was damaged beyond repair at White Waltham.

I should be very grateful if any reader of *Flight* could supply me with further information regarding this aircraft's service in Britain. Was it used by B.O.A.C., or by which other body? Which R.A.F. unit operated this aircraft? When and how was it "damaged beyond repair?"

Harald Hansen, chief pilot of D.D.L., had flown OY-DAM over to England on April 8, 1940. During the war, he lost his life in an air accident in Britain. Was he still flying the Condor, or what was his occupation in Britain?

I should like to express my gratitude to *Flight* for bringing readers such fine historical articles. I do hope that the Ensign story is not the last one dealing with famous British transports.

Charlottenlund, Denmark. HANS KOFOED.

[As it happens, statements in a letter (below) from Mr. Moss answer some of our correspondent's queries—Ed.]

YOUR correspondent Mr. R. T. A. Dalton, in his letter "Refugees from Hitler" (March 1), was quite correct in identifying G-AGAY and G-AGBI as OY-DAM and PH-ARW respectively. But your readers may like to learn more about OY-DAM's war-time history: after the Condor's "capture" at Shoreham the airliner was re-registered G-AGAY to the Secretary of State for Air in May 1940. By this time, B.O.A.C. were using the aircraft for short freight hauls, usually with fighter escort, and it was ironically named *Wolf* in the company's fleet list. Owing to the many difficulties involved in flying a German type peacefully around the British skies, B.O.A.C. handed *Wolf* over to the R.A.F. on January 9, 1941, and her identity became DX177. Whether or not *Wolf* was wearing military markings at the time of her decease is not known: but it is known that the aircraft was damaged beyond repair at White Waltham in August 1941, due to overshooting the boundary while landing there. Incidentally, OY-DAM was named *Dania* during her service with the original owners, Det Danske Luftfartselskab, before the war.

The DC-3, G-AGBB, also mentioned in my Ensign history, was previously PH-ALI of K.L.M. named *Ibis* (the first DC-3 to land in Great Britain), and was also a refugee from Hitler. *Ibis* was re-registered G-AGBB to Royal Dutch Air Lines in July 1940 and was operated on the U.K. - Lisbon - Gibraltar route until 1943. On June 1, 1943, *Ibis* was returning to the U.K. from Lisbon, when she was deliberately attacked by German fighters over the Bay of Biscay and shot down with the loss of all on board, including the famous actor Leslie Howard. The Germans were under the impression that Winston Churchill was on board, as a portly figure had been seen to enter the aircraft at Lisbon.

Ruislip, Middlesex. PETER W. MOSS.

THE two recent features on the Ensign-class airliners, by Peter Moss, have prompted me to write to you enclosing two photographs [unfortunately unsuitable for reproduction—Ed.] relating to aircraft G-ADTC.

On June 28, 1940, *Endymion* touched-down at R.A.F. North Coates Fittes with a Ford Trimotor and a Harrow to ferry gunnery-school personnel to the Isle of Man. I was a member of this party and made the trip in *Endymion*. The Harrow and the old Trimotor left some time before *"Endy,"* along with three obsolete Hart target-tugs, only to be all overtaken by the Ensign shortly after we had seen Blackpool fade behind.

I remember only too well the really short take-off but slow climb-rate from North Coates. Also, being seated at the rear port-side of the lower deck, I had an excellent view of that fantastic undercart coming up—it was certainly "retraction in slow-motion!" I seem to remember a system of pulleys and cables coming into operation—or am I a trifle confused?

Port Erin, I.o.M. DONALD G. DOBSON.

*The Tiger Moth referred to (third letter below) by Mr. N. Collier.*

IN August 1944 I flew from Karachi to Cairo (*via* Sharja, Bahrain, Baghdad and Wilhelma, Palestine) in Ensign G-ADSV *Explorer*, so I was particularly interested in Mr. Moss's painstaking biography of these stately aircraft.

He remarks that the time taken for undercarriage retraction was 70 sec, but does not mention what an entertaining business it was for passengers to watch that complicated oleo leg fold up into or descend from the engine nacelle in the high wing. The process seemed to take far longer than 70 sec and always left one with a nice feeling of uncertainty. It reminded me of the American crack about a Stirling being an expensive way of getting an undercarriage airborne.

London, N.W.3. PAUL HUMPHREYS.

### No Manual Reversion

IN your issue of March 1, it is stated that the Fairey Delta 2 was the first aircraft in this country to fly with powered controls with no means of manual reversion.

While not wishing to suggest that to be first in this field has any particular significance, I think that in the interests of accuracy it should be stated that Handley Page, Ltd., have flown aeroplanes with fully duplicated power controls, and without manual reversion, since 1952. R. S. STAFFORD

London, N.W.2. (Technical Director, Handley Page, Ltd.).

[The statement referred to by Mr. Stafford was made in the course of an R.Ae.S. lecture (Peter Twiss) which we reported in the issue he mentions.—Ed.]

### Tiger Moths from Australia

AFTER reading the caption to an illustration of the R.A.A.F.'s disposal of its last ten Tiger Moths in service (page 125, *Flight*, January 25) I am prompted to send a photograph [reproduced above—Ed.] and details of a similar machine—A.17-84—in service with the Royal Navy in the United Kingdom.

This unique example first attracted my attention in 1950 when it was based at Roborough on the strength of the Royal Naval Engineering College; it was still there to as late as July 1955. The Australian prefix letter and type number have, in this instance, been grouped close together under the wings, and on the fuselage, in keeping with the British method of application.

I know of no other ex-R.A.A.F. Tiger Moths in service with the Royal Navy, so perhaps some other reader could shed some light on the history of A.17-84? At least two Australian Tiger Moths have found their way across the seas to the United Kingdom civil register of aircraft—these being: A.17-125 (became VH-AVD, later G-AKCG, in 1947); A.17-228 (became VH-BDK, later G-AKCI, in 1947).

Although these two are no longer in current use in the U.K. their importation contrasts sharply with the constant export of ex-R.A.F. machines to Australia each month.

Sidmouth, Devon. N. COLLIER.

### B.E.A. and the Helicopter

I READ your article "Old Sores" (page 257, February 22 issue) with much interest, and felt that your remarks about the demise of British helicopter operations could have been stronger. It is up to B.E.A. to keep pressing the industry hard, to keep their helicopter ideas and beliefs alive with daily experience and—even though limited to uneconomic single-engined types—to keep injecting these ideas and beliefs into the industry and the Ministry of Transport and Civil Aviation.

The Minister is always saying "My department is looking into" this or that; but he won't have any incentive even to *look into* things—let alone get them done—if Britain's helicopter effort is to relax even for a moment. Such things as landing sites, navaids, lighting, bad-weather aids, and so on—all these things are vital to the success of national helicopter operations and they won't happen overnight when the "economic" helicopter comes along. The Minister has got to look into these things now, prodded by B.E.A., who have also got to prod the local planners. It will be no use towns and cities clamouring for the benefits of helicopter service when the economic helicopter comes along: they've got to include heliports and technical facilities *now* in their forward

## CORRESPONDENCE . . .

planning. As it is, they're just not thinking about them much—they're far too interested in schools, roads and hospitals.

It is all right to say that B.E.A. have learned enough about helicopter operations for the time being. They've certainly learned a great deal, not just on scheduled services but from the experimental work done by the helicopter unit on night flying, Decca, etc. But I'm sure they've got to keep at it, to build up, day by day, real operational know-how, and real helicopter-consciousness in the minds of the planners and the public. It will cost money, some of it B.E.A.'s money, but it's short-sighted to forget the long-term advantages to U.K. commerce and communications—which are the most congested in the world—of high-frequency intercity and airport-to-airport helicopter travel.

And it's short-sighted to relax the efforts of the helicopter- and turbine-manufacturing industry, which is potentially the best in the world, but which can only—like the rest of the aircraft industry—capture export markets on the strength of a domestic market and solid domestic experience. We always say that the American fixed-wing transport aircraft industry dominates the world market because of its ideal home market. Why shouldn't the rotary-wing industry of this country, with its ideal home market for helicopters—surface congestion, high density of populations and centres of commerce—dominate the world market?

People may say that, after all, the helicopter is perhaps not the eventual answer, and that V.T.O.L. or S.T.O.L. aircraft may be. V.T.O.L. may in due course oust the helicopter, though S.T.O.L. probably won't—in Europe's built-up cities, at any rate. But V.T.O.L. is the sequel, not the alternative, to the helicopter, both in design and operation. It would be foolish to suggest you could build successful V.T.O.L. on anything but strong helicopter foundations.

There is the danger that, while B.E.A. sits back and awaits the advent of an economic helicopter, the industry will sit back and await the advent of operations for which to build the economic helicopter. Who knows what an economic helicopter is except the operator, and how can he know unless he amasses—as other operators in Europe and the U.S.A. are doing—experience, experience, experience?

London, W.1. SISYPHUS.

### The Disbandment

I HAVE been reading with morbid interest the letters recently published in *Flight* as regards the disbandment of the R.Aux.A.F. and R.N.V.R. Air Branch, and would like to add my own comments as one now (fortunately), divorced from almost all British aeronautical disactivity.

To the members of the Auxiliary forces I should like to offer my sincere condolences on being axed due to their no longer being fit and able to wage war on such ultra-modern mounts as the Hunter, Gannet or Seahawk—which I anticipate will be "front-line" for at least another five years.

To the Government I say thank you for putting us ahead—on paper at least—of the rest of the world in air defence methods. Here's to the imported squib and to the dickens with squadron tradition and enthusiasm. The money saved in the three or four years till we start trials with the pyrotechnics can be used to provide false teeth, aspirin tablets and unemployment benefit to long-haired immigrants from abroad.

To the general public I wish a long and happy period of utter and complete rest from jet noises on Sunday afternoons. Mother and kids will be able to watch TV undisturbed by a cacophony of turbines, whilst father does double-time at the local aircraft factory in the deadly silence of a fully active machine-shop. Let us never forget that they are probably those who, in 1940, asked "Where are our fighters?"

Let us, therefore, give thanks for what joy has been sent us, and put our names down for export to you-know-where. Even at the ripe old age of 30, no doubt, I can manage to get in the Californian or some such National Guard on old-fashioned F-86s.

Bristol. P. H. DOBBS.

### All-through Jet Training

I REFER to Mr. Frank Holt's letter on page 220 of your issue of February 15. I have no idea whether he is basing his pessimism about the cost of all-through jet training on actual figures, or whether he is doing some shrewd guessing. My information, which refers only to the Jet Provost (surely Authority will soon give it a more suitable name—something quite individual, having no regard to parentage?) tends to show that such pessimism is unfounded.

The ultimate cost to the Service is not merely a matter of the greater cost of the aircraft or the increased amount of fuel used per operating hour. Although it has been estimated that in full production the Jet Provost will cost only some five per cent more than its piston-engined counterpart, and although jet fuel is considerably cheaper than high-octane fuel, consideration has to be given to the fact that, in the Provost/Vampire training syllabus, considerably more Vampire hours are necessary than in the Jet Provost/Vampire scheme: this follows naturally because of the jet conversion necessary, and because under the new scheme many exercises that would normally be performed in the Vampire can now be just as easily taught and practised in the Jet Provost.

On an even wider canvas, if all-through jet training leads to a general reduction in the accident rate, here is saving of very real worth, not merely in the training stage, but right up to the time when the pilot is a member of a squadron flying fantastically expensive operational aircraft.

I would mention that there is no reason to suppose that the maintenance cost of the Jet Provost will be higher than that of the Provost, and would point out that the relative freedom from vibration may well lengthen the lives of instruments and radio components.

Surely the case for all-through jet training is overwhelmingly strong?

I have said that I refer only to the Jet Provost. But since I do not agree with the saw that comparisons are odious, I would welcome information on the operating costs of such aircraft as the Fouga Magister, the Somers-Kendall S.K.1, and the Carma Weejet.

Weston-super-Mare, Somerset. J. M. D. BROOKS.

[Hunting-Percival's comments on Mr. Frank Holt's letter were published in our issue of March 1, page 262, and another letter on the subject, with further observations by the manufacturers of the Jet Provost, appeared in the Correspondence pages last week —Ed.]

### Processing the Politician

THE Glass Age Development Committee's V.T.O.L. and heliport project for St. Giles' Circus (illustrated on page 259 of the February 22 issue of *Flight*) is indeed fascinating. But there is one thing that seems to have been left out, and which ought to be made a mandatory requirement at all international airports.

What is needed is a gigantic ivory tower built specially for the statesmen who spend their time hurrying across the oceans from one summit conference to another. This structure would, in reality, be a kind of mental and moral decompression chamber in which the unworldliness and lack of realism induced by the extremely high moral altitudes of international conferences would be dissipated from the system, and replaced by more positive and vigorous mental qualities.

It would have to be done painlessly, of course; the unsuspecting V.I.P. would be lured into a Hall of Platitudes, where soothing voices from concealed tape recorders would lull him to sleep by repeating over and over again well-known political catch-phrases. The victim would then be treated in various stages until, with a final injection of a common-sense drug, he would emerge a completely new man.

Futuristic? Maybe—but then so was the jet airliner once!

Rustington, Sussex. M. J. HARDY.

### FORTHCOMING EVENTS

Mar. 15. Institute of Transport: Annual Dinner.
Mar. 19. R.Ae.S.: Graduates and Students Section: "Gas Turbines for Helicopters," by A. W. Morley.
Mar. 21. R.Ae.S.: Section Lecture: "Application of Automatic Digital Computers to Aeronautical Problems," by Dr. S. H. Hollingdale.
Mar. 26. R.Ae.S.: Main Lecture at Reading: "Present and Future Developments in Civil Aviation," by P. G. Masefield, M.A. (Eng.), F.R.Ae.S.
Apr. 1-6. Southampton University: Course on Aircraft Acoustics.
Apr. 4. R.Ae.S.: Main Lecture: "Engine-Airframe Integration," by L. F. Nicholson, F.R.Ae.S.
Apr. 5. A.B.A.C.: Annual Dinner.
Apr. 6. British Interplanetary Society: "History of Rocket Development in the Walterwerke," by H. Walder.
Apr. 8. Helicopter Association: "Problems Associated with the Strength Assessment of Rotor Blades," by V. A. B. Rogers, D.C.Ae., A.F.R.Ae.S.
Apr. 9. Aviation Forum: Annual General Meeting.
Apr. 9. R.Ae.S.: Section Lecture: "Fail-Safe Structural Design," by N. F. Harpur, Grad.R.Ae.S.
May 4. British Interplanetary Society: Film Show.
May 24-June 2. Paris Aero Show, Le Bourget.
Sept. 2-8. S.B.A.C. Show, Farnborough.

**R.Ae.S. Branch Fixtures (to April 2)**

Mar. 15, *Birmingham*, "Medical Aspects of High-Speed Flying," by G/C. W. K. Stewart. Mar. 18, *Derby*, "Operational Problems of Jet Airliners," by W. O. Challier; *Henlow*, Film Show. Mar. 19, *Glasgow*, "Titanium," by R. L. Preece. Mar. 20, *Brough*, "High Speed Flight," by Col. C. Yeager; *Christchurch*, "Aviation Journalism," by C. Gardner; *Merthyr Tydfil*, Talk by Member of Douglas Aircraft Co.; *Weybridge*, "Problems of Jet Transport Operation," by J. T. Dyment. Mar. 21, *Yeovil*, "Fundamental Particles of Physics," by C. C. Butler Mar. 27, *Leicester*, "Helicopters," by R. Hafner; *Luton*, Annual General Meeting; *Preston*, "Aerial Survey," by B. J. Atwell. Apr. 2, *Boscombe Down*, "High-speed Experimental Test-flying," by Col. C. Yeager.

*Mr. H. Sammons, managing director of D. Napier and Son, Ltd., presents the Company's Trophy to Roy Blanchflower (see report below).*

# THE INDUSTRY

## Napier Apprentices' Prizegiving

FOUR hundred apprentices, their parents, and others interested filled Acton Town Hall when D. Napier and Son, Ltd., held their 12th annual apprentices' presentation at the end of what was described as "the best year, academically, in the history of the company's apprenticeship scheme."

Mr. J. F. A. Radford, chief of personnel and training, said the company were training 45 graduates and special trainees, 87 students and 295 trade apprentices—a total of 427. The number of technicians and technologists now under training was three times that of 1951.

Reporting the academic achievements of Napier apprentices in the year just ended, Mr. Radford stated that of those who had sat the various examinations more than 73 per cent had passed. He went on to name several who had particularly distinguished themselves. In the City and Guilds courses, A. Carey, W. Edwards, R. Leggett, J. Salmon, G. Shankster and R. Young had averaged between 74 and 80 per cent. In the Ordinary National Certificate examinations, A. G. M. Davis, B. V. George, R. A. F. Williams and M. E. Ward had all attained more than 80 per cent; and George had gained 100 per cent in mathematics. Students who had obtained more than 80 per cent in the Higher National Certificate examinations were B. R. Davies, G. Evans, P. Hensby, J. Seddon, F. J. Thomas and W. H. Walker. Francis Thomas had been awarded a James Clayton Prize, and Colin Blamey had had his name placed on the reserve list for a State scholarship. Roy Blanchflower had gained a first-class honours degree, and Tom Collins a second-class honours degree, from Northampton Engineering College.

The guest-speaker was Maj-Gen. C. Lloyd, C.B., C.B.E., T.D., B.Sc., F.Inst.P., director of the Department of Technology, City and Guilds of London Institute, and Mr. H. Sammons, C.B.E., Napier managing director, also addressed the assembly.

## Technical Publications Service

THOUGH most of the larger firms in the industry maintain their own technical publications departments there are occasions when design or production pressure makes it desirable to "farm out" work to a competent organization outside; and in the case of many of the smaller companies the need for such assistance is more or less continuous.

A firm specializing in work of this kind is Studio Irwin Technical, Ltd. (8 Breams Buildings, London, E.C.4), who state that they offer a complete service for the engineer, including preparation of instructional material, handbooks, and sectioned and "exploded" illustrations in line, half-tone or colour. An electronics section is equipped to deal with any type of circuit diagram or other illustration required in this particular field.

Studio Irwin Technical, who emphasize that they are not an advertising agency, have recently taken over large premises and increased their capacity. They are contractors to H.M. Government.

## Dielectric Test Set

WITH the aim of determining the electrical qualities and behaviour of plastics and other materials under the extremely high frequencies used in present-day radar systems, a dielectric test set has been developed by Microcell Electronics, a division of Microcell, Ltd., 56 Kingsway, London, W.C.2. One application of the dielectric set is for testing such materials for use in aircraft radomes. It measures electrical characteristics at temperatures comparable with the high surface temperatures—which may rise by more than 150 deg C—generated by supersonic aircraft.

Controls have been kept to a minimum in the Microcell equipment and critical adjustments eliminated, so that personnel without detailed knowledge of electronics or experience of microwave measurements can use it. The instrument is stated to give direct reading of permittivity and loss tangent for small samples of resins or plastics at fixed-spot frequencies in the 8,500-9,600 Mc/s band. An oven is provided to enable the temperature of the sample to be increased to a maximum of about 500 deg C while measurements of permittivity and loss tangent are carried out.

## New Flexible Ducting

A NEW range of lightweight flexible ducting, under the name "Flexflyte," has lately been marketed for the aircraft industry by Avica Equipment, Ltd., of Mark Road, Hemel Hempstead, Herts. Three types are produced, as follows:—

**Flexflyte U,** recommended for conveying air, either hot or cold. Construction: Single-ply; galvanized steel wire helix covered with coated glass-fibre or coated cotton, cemented and bound with coated glass-fibre cord; coatings available, neoprene, nitrile or p.v.c.

**Flexflyte L,** for use where stronger mechanical construction, smoother bore and higher insulation values are required for conveyance of hot or cold air. Construction: Two-ply, inner ply coated on one side with glass-fibre or double-coated cotton; helix as above; cementing as above; coatings available, neoprene, nitrile or silicone rubber.

**Flexflyte LR,** for conveying oil-saturated air, or air carrying abrasive matter. Construction: Two-ply, inner ply of neoprene sheet; galvanized steel wire helix; outer ply, neoprene-coated glass-fibre or coated cotton; cementing as above.

In each case, extra-ply reinforcement is provided at the cuff ends. The ducting is available in a wide range of internal diameters, and general advantages claimed include the following: light weight; extreme flexibility, permitting close-radius bends of up to 180 deg yet maintaining internal smoothness; pressure-resistance (standard grades) of up to 70 lb/sq in internal and 15 lb/sq in external; temperature-resistance from −120 deg F to 650 deg F without loss of flexibility; and good flame-resistance (the material will char, but not support combustion).

# IN BRIEF

*Mr. S. Rymell, who, as reported in these columns last week, has been appointed general manager of Folland Aircraft, Ltd. For the past three years he has been the company's chief inspector, and before that was with Westland Aircraft.*

The new Sciaky "Rapid" range of spot welders is illustrated and described in a brochure issued by Sciaky Electric Welding Machines, Ltd., Falmouth Road, Slough, Bucks.

* * *

Aeronautical Trades and Manufacturing Co., Ltd., formerly of Camberwell New Road, moved on March 1 to Aero House, 1 Wyndham Road, London, S.E.5 (Rodney 7209).

* * *

A book of data sheets providing concise tabulated information on the treatment, characteristics and typical applications of light alloys has been produced by Sterling Metals, Ltd., Coventry.

* * *

A very small, 400 c/s high-performance axial-flow fan has been produced by Woods of Colchester, Ltd., for aircraft applications, chiefly for cooling electronic apparatus. Designed to comply with the DEF. 5000 and K. 114 specifications, it is a downstream guide-vane fan, with an impeller of 2.4in diameter and an overall length of 3¾in. Its weight is under 1 lb.

* * *

Mr. Henry F. Spencer has been appointed chairman of the Board of the R.F.D. Co., Ltd. Managing director of Richard Thomas and Baldwins, chairman of the South Wales Tinplate Corporation and life vice-president of the British Institute of Management, he became a director of the R.F.D. Co., Ltd., last November. Mr. A. van Beugen Bik, who acted as temporary chairman until Mr. Spencer's appointment, will continue to serve as managing director.

# SERVICE AVIATION

*Royal Air Force and Fleet Air Arm News*

*Prince Philip inspects No. 601 (County of London) Sqn., R.Aux.A.F., before taking the salute at their final parade (see adjoining paragraph). On the right, the Duke of Gloucester puts on a Mae West at the R.N. Air Station, Culdrose, Cornwall, before flying out by Westland Whirlwind on March 5 to visit the aircraft carrier H.M.S. "Albion" twenty miles off the Lizard.*

### Royal Farewell to No. 601 Sqn.

PRINCE PHILIP, honorary air commodore of No. 601 (County of London) Sqn., R.Aux.A.F., took the salute at a final parade on March 6 outside the squadron headquarters in Kensington Park Road, W.11.

Before the members, under their commanding officer, S/L. P. R. Edelston, marched past for the last time as a squadron, Prince Philip said: "I just want to say good-bye and—I expect nobody else will say it—to thank you for the service you have given to this squadron, to the Auxiliary Air Force and to your country in peace and war."

He then added: "This is a very sad moment for all of us—for this squadron and the whole of the Auxiliary Air Force. I want to wish you the very best of luck in the future. If, by any chance, you still have the urge to give some sort of service to your country, there are many other ways of doing it."

### C.A.S. in Australasia

AFTER attending SEATO conferences in Canberra up to March 13, Air Chief Marshal Sir Dermot Boyle, the C.A.S., was due to inspect guided missile and atomic weapon testing grounds and to have informal talks with the R.A.A.F. and R.N.Z.A.F. Chiefs of Air Staff. From New Zealand, Sir Dermot is returning home by Comet 2 of R.A.F. Transport Command, with stops at Ceylon, Aden and Nicosia, for talks with local R.A.F. commanders.

### New Air Chief Marshals

ON March 5 the Air Ministry announced that Air Marshal Sir Harry Broadhurst, A.O.C-in-C. Bomber Command, and Air Marshal Sir Claude Pelly, Controller of Aircraft, Ministry of Supply, had been promoted to Air Chief Marshal with effect from February 14.

Air Chief Marshal Broadhurst, who is 51, has been A.O.C-in-C. Bomber Command, since January 1956. Before that he was C-in-C. 2nd ATAF. He joined the R.A.F. in 1926 and during the early part of the war fought in France and the Battle of Britain and led many fighter sweeps. In 1940-41 he was awarded four decorations for gallantry—two D.S.O.s and two D.F.C.s.

Air Chief Marshal Pelly, who is 54, has been Controller of Aircraft at the M.o.S. since November last year, having previously been C-in-C. M.E.A.F. for three years. He entered the R.A.F. College, Cranwell, in 1920 and in 1933 was awarded the M.C. while serving in Iraq.

### W.R.A.F. Senior Appointments

TWO senior W.R.A.F. officers recently exchanged positions, G/O. Louise Turner, O.B.E., W.R.A.F. Staff Officer at headquarters, 2nd ATAF, since April 1954, becoming Deputy Director of the W.R.A.F., and G/O. Ann Stephens, M.B.E., who has been Deputy Director since April 1954, becoming W.R.A.F. Staff Officer at headquarters, 2nd ATAF.

G/O. Turner joined the W.A.A.F. in October 1939 and was commissioned in April 1940. Prior to her appointment at 2nd ATAF she was W.R.A.F. Staff Officer at Headquarters, Home Command, from October 1952.

G/O. Stephens joined the W.A.A.F. on its formation in 1939. She was one of the first W.A.A.F. officers to go to the Continent after D-Day and her post-war appointments have included that of W.A.A.F. Staff Officer at H.Q. Maintenance and Technical Training Commands, and command of R.A.F. Hawkinge.

### R.A.F. Chaplain to the Queen

THE QUEEN has approved the appointment of the Rev. J. N. Keeling, M.A., R.A.F., as an honorary chaplain to Her Majesty, it was announced in the *London Gazette* on March 5.

Mr. Keeling has been Assistant Chaplain-in-Chief at Air Ministry since February 11 this year. Previously he had held similar appointments with Bomber Command and (until October 1955) with Home Command. He was commissioned in the R.A.F. in August 1937.

### Record Malayan Drop

ON February 28, R.A.F. Valetta aircraft of the Far East Transport Wing, operating from Kuala Lumpur, broke the record for a day's drop of supplies to security forces in the Malayan jungle. Flying from dawn until dusk, six Valettas—two each from Nos. 48, 52 and 110 Squadrons—dropped 64,765 lb of supplies on 32 dropping zones from the Thai border to south Johore State. The previous record, set up on April 7 last year, was 64,485 lb. F/L. K. Robinson, detachment commander of the Far East Transport Wing, said afterwards that the day's task had been completed by afternoon, but "conditions were so good we pressed on dropping supplies due the following day."

### The Beverley Accident

ON March 6 the Air Minister, Mr. George Ward, made a statement in Parliament about the R.A.F. Beverley of No. 53 Squadron which crashed near Drayton, Berks, the previous day shortly after taking off from Abingdon.

He said that the aircraft, bound for Malta and Cyprus, reported engine trouble and was returning to the airfield. The dead included three members of the crew, 12 officers and airmen flying as passengers, and two civilians in the house which was demolished. Two members of the crew, one passenger and two civilians were injured. A Court of Inquiry had assembled that morning.

In answer to questions, Mr. Ward said that there was no evidence to suggest that Beverleys should be grounded, or any restrictions put on them, as they had already done thousands of hours' flying on Transport Command routes "without any major accident of any kind."

Last weekend the Air Ministry denied that sabotage might have been responsible for the Beverley accident, or that there had been any such possibility in the case of the four Beverleys which in recent weeks had had to turn back to Abingdon with engine trouble; the reasons for this had been investigated and the technical problems solved.

### F.A.A. Strength

IN answer to a question recently the Parliamentary and Financial Secretary to the Admiralty, Mr. Christopher Soames, said it was not in the public interest to disclose the strength or disposition of Fleet Air Arm squadrons; but it could be stated that of the total number, 50 per cent either are or readily could be embarked in carriers now in commission. The total number of men in the F.A.A. on September 30 last was 16,763.

### R.A.F. Appointments

THE following continues a list of Royal Air Force appointments issued periodically by the Air Ministry:—

G/C. S. W. B. Menaul to R.A.F. Lindholme, to command; G/C. K. S. Batchelor to R.A.F. Swinderby, to command; G/C. J. M. Thompson to R.A.F. Leeming, to command; G/C. S. G. Wise to Air Ministry, for duty in the Department of the Chief of Air Staff; G/C. P. A. Lombard to Joint Anti-Submarine School, Londonderry, as R.A.F. c.o. and Director (he will also become Senior R.A.F. Officer, Northern Ireland); G/C. R. A. McMurtrie to H.Q. Coastal Command, for air staff duties; G/C. D. G. Keddie to Directing Staff, Royal Naval College, Greenwich; Acting G/C. R. K. Jeffries to Air Ministry for duty in the Department of the Air Member for Supply and Organization; Acting G/C. E. Earnshaw to R.A.F. Wellesbourne Mountford, to command.

W/C. A. A. McGregor to H.Q. Fighter Command, for administrative staff duties (with acting rank of G/C.); W/C. J. J. Dennis to Air

*Queen Elizabeth the Queen Mother, honorary air commodore of Nos. 600 and 2600 (City of London) Sqns., R.Aux.A.F., inspects the squadrons at their final parade in Finsbury Barracks, London, last Sunday. Later the No. 600 Sqn. Standard was laid up in the Priory Church of St. Bartholomew-the-Great, Smithfield. (Both occasions are described in an "All Quarters" news item on p. 324.*

## SERVICE AVIATION...

Ministry for duty in the Department of the Air Member for Supply and Organization; W/C. R. C. Skelton to Air Ministry for duty in the Department of the Chief of Air Staff; W/C. A. Ovenden to H.Q., 2nd ATAF, for technical staff duties; W/C. T. G. Young to H.Q., 2nd ATAF, for technical staff duties; W/C. W. A. D. Gardner to R.A.F. Londonderry, for R.A.F. Regiment duties; Acting W/C. L. C. Noon to R.A.F. Wellesbourne Mountford, for technical duties; Acting W/C. P. D. Scott to H.Q., No. 22 Group, for administrative staff duties.

W/C. F. H. Kelly to R.A.F. Stafford, for administrative duties; W/C. W. A. Covill to H.Q., FEAF, for administrative staff duties; W/C. D. J. Lynch, to Ministry of Supply; W/C. J. W. C. N. Young to H.Q., British Forces Arabian Peninsula, for administrative staff duties; W/C. J. T. Morris to Ministry of Supply; W/C I. Roberts to Air Ministry for duty in the Department of the Air Member for Supply and Organization; W/C. G. H. Tebboth to Air Ministry for duty in the Department of the Air Member for Supply and Organization; W/C. W. C. H. Oatey to R.A.F. Driffield, for technical duties; W/C. H. B. Hurley to R.A.F. Middleton St. George, for technical duties; W/C. G. T. Dale to R.A.F. Gutersloh, for technical duties; W/O. M. F. Arkell, W.R.A.F., to H.Q., Coastal Command, for administrative staff duties; Acting W/C. N. L. Williamson to Ministry of Supply; Acting Wg/O. D. V. M. Gray, W.R.A.F., to Air Ministry, for duty in the Department of the Air Member for Personnel.

S/L. L. L. Flowerdew to R.A.F. Celle, for technical duties (with rank of wing commander); S/L. V. O. Joseph to H.Q., FEAF, for air staff duties (with acting rank of wing commander); S/L. T. S. Wilkinson to A.H.Q., Levant, for technical staff duties (with acting rank of wing commander); S/L. R. G. Seymour to H.Q. MEAF, for technical staff duties (with acting rank of wing commander).

### V.C.A.S. at C.U.A.S. Dinner

AT the jubilee dinner of Cambridge University Air Squadron last Friday, Air Chief Marshal Sir Ronald Ivelaw-Chapman, V.C.A.S., said the contention that the guided missile era was here and the R.A.F. only needed "a posse of scientists to press the right button at the right time" was a theory "bristling with fallacies." In this country the era would only come about as part of a process taking many years to complete.

The guided missile would be welcome, just as every new instrument of air power that had come into the R.A.F. had been welcomed; but only when it worked efficiently and was available in sufficient quantity to take over the task of its manned counterpart.

### Goodwill Mission

FOUR Shackletons of No. 224 Sqn. (W/C. G. E. Willis), R.A.F. Coastal Command, are due to leave their base at Gibraltar tomorrow on a 16,171-mile flight to South America and the Caribbean. The force commander will be A. Cdre. J. D. Miller, A.O.C. R.A.F. Gibraltar, and among places the aircraft are to visit during their thirty-two days' tour are Rio de Janeiro, Buenos Aires, Santiago, Lima and Bermuda.

### R.A.F. M.O.'s Gallantry

WHEN in a recent issue the *London Gazette* announced the award of the Air Force Cross to F/O. J. C. M. Wilkinson, a medical officer at R.A.F. Changi, Singapore, the accompanying citation spoke of his "outstanding example of devotion to duty and to his profession."

When, on December 3 last year, a radio message was received from Christmas Island saying that the wife of the resident doctor was seriously ill and that another doctor, supplies of blood and transfusion apparatus were urgently needed to save her life, F/O. Wilkinson volunteered to drop by parachute as sea conditions prohibited a flying-boat landing.

Owing to the bad weather conditions, he had to make his descent from 800ft into a dropping zone only 200 yd wide, with a surface wind of 18 kt—though in 21 training drops he had never encountered winds greater than 10-12 kt. Not only, however, was his descent successful; he located the supplies and supervised the transfusion which saved the patient's life. F/O. Wilkinson's action, says the citation, "in parachuting over strange territory in adverse weather conditions, showed courage and determination of a very high order."

### Reunion

IT is announced that No. 16 Squadron Association will hold its annual dinner at the Royal Air Force Club, 128 Piccadilly, London, W.1, on Saturday, May 18. Cost, 30s; dress, dinner jackets or evening dress. Ex-members who have not received an invitation should write to S/L. G. Walkington, R.A.F. Wunstorf, B.A.O.R. 5.

*Admiral Sir Mark Pizey, C-in-C. Plymouth (left), presenting wings at a passing-out parade last Friday of the Observer School at H.M.S. "Seahawk," R.N.A.S. Culdrose, Cornwall. This was the first wings parade the Admiral had ever attended.*

*An R.A.F. Sycamore shortly after landing with a casualty at Dhala airstrip during recent operations near the Aden-Yemeni frontier. The wounded soldier, a Cameron Highlander, is about to be transferred to an R.A.F. Pembroke to be flown on to hospital.*

*A picture which captures something of the frostbite-conditions experienced by Bristol Britannia 312 during the recent cold-weather trials at Winnipeg. The aircraft is seen here at Stevenson Field before taking off in a 40 m.p.h. blizzard.*

# CIVIL AVIATION

## AIR FRANCE ORDER MORE 707s

IT was announced in Paris last week that Air France have increased their order for ten Boeing 707-320s to 17, bringing the total value of the company's contract to £38m. Air France's first aircraft will be delivered in May 1959, and all 17 will be delivered by November 1960. This is the largest export order for either Boeing 707s or DC-8s.

At no time since Air France's first 707 order was announced has the airline stated the type of engine which would be fitted. The company now say that the choice is "likely to lie between the Pratt and Whitney JT4 and the Rolls-Royce Conway."

## CAPITAL COMETS ON PUERTO RICO RUN?

THE possibility that Capital Airlines may operate Comets on routes from U.S. cities to San Juan, Puerto Rico, arose last week when the airline filed an application with the C.A.B. for permission to operate this route. In this application Capital are reported to have said that the Comet—which the airline has stated will enter service on January 1, 1959—was "ideally suited" for the Puerto Rican run, and would cut flying time from New York to 3 hours compared with 5¼ hours now scheduled for DC-6Bs.

Capital's application is being opposed—according to a Reuter report from Washington—by Pan American, who say that the Puerto Rico service now provided by PanAm and Eastern was adequate and that no additional airlines should be admitted into that area.

## AIR SAFETY BOARD CHANGES

AT the invitation of the Minister of Transport and Civil Aviation, Mr. Harold Watkinson, Mr. A. G. Elliott has joined the Air Safety Board in place of Sir Leonard Bairstow, who has resigned because of ill-health. Also joining the Board is Air Marshal Sir Charles Guest, who was appointed additional aeronautical adviser to the Minister last October.

Mr. Elliott, C.B.E., F.R.Ae.S., M.I.Mech.E., M.S.A.E., F.R.S.A., is a member of the Air Registration Board. His long career in aviation has been spent almost entirely with Rolls-Royce, where he was responsible for the design of many engines, including the Merlin. He was executive vice-chairman of the company from 1954 to 1956, when he retired.

Sir Charles Guest, K.B.E., C.B., who joined the Royal Air Force in 1918, became A.O.C. Transport Command in 1952. In 1954 he was appointed Inspector General. While in this capacity he was responsible to the Air Council for reviewing and reporting on the accident investigation organization in the R.A.F.

The last change in the Air Safety Board's membership was in March 1955, when Sir William Farren replaced A. Cdre. F. R. Banks. The composition of the Board is now: Air Chief Marshal Sir Frederick Bowhill (chairman), Lord Brabazon of Tara, Sir Arnold Hall, Sir William Farren, Air Marshal Sir Charles Guest, and Mr. A. G. Elliott.

## BRITANNIA ACROSS THE ATLANTIC

HOPES that 48 Britannias will be built during the next twelve months were voiced by Mr. Peter Masefield, Bristol Aircraft's managing director, in New York on March 7. He was homeward-bound from San Francisco in Britannia 312 G-AOVA (see photograph above). He hoped also that Bristol would, in the near future, sell a further 20 Britannias in addition to the 65 already sold. G-AOVA returned to Bristol, *via* Rome, last Saturday.

This news coincided with a report that B.O.A.C. may introduce Britannia 312s on to their Atlantic routes in July, and that a provisional date of July 15 had been fixed. This report, which B.O.A.C. "hope to be in a position to confirm" in the near future, followed recent conjecture as to which airline—El Al or B.O.A.C.—will be the first across the Atlantic with Britannias. El Al are also reported to be planning to start transatlantic Britannia services in July (*Flight*, March 1).

During inspection of Britannia G-AOVA at San Francisco it was discovered that in addition to the engine which, as a result of generator failure, had suffered an oil leak, another engine had developed turbine "rub." Mr. Peter Masefield is reported to have said that he believed this had been caused by "uneven expansion of metal parts" when the engines were started in −50 deg C weather tests in Canada.

## SOLID BLADES FOR STRATOCRUISERS

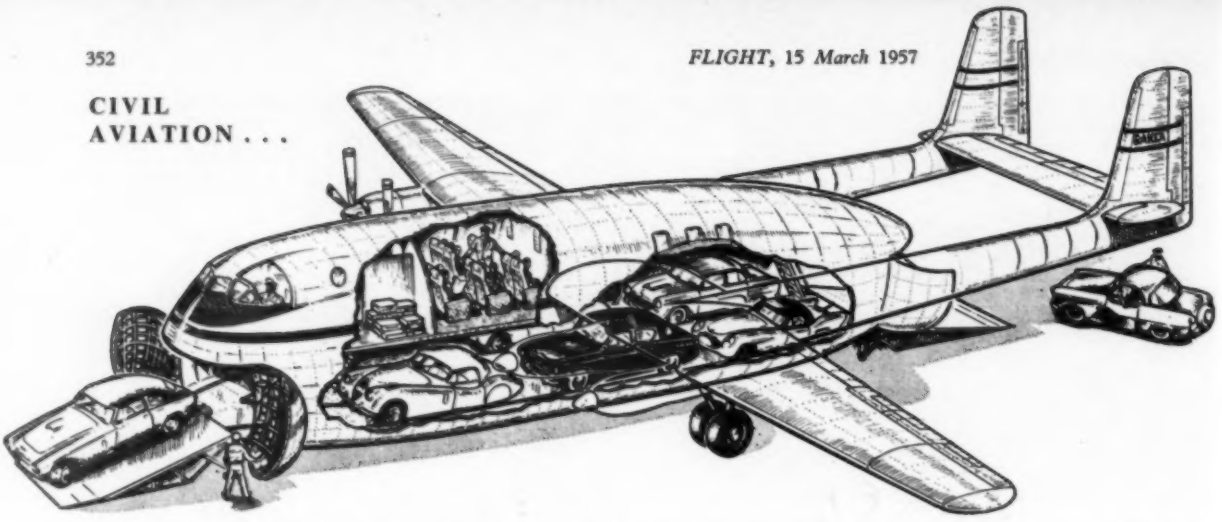
THE Hamilton Standard hollow-steel-blade propellers which have been a standard installation on the Boeing Stratocruiser are, an American source reports, to be replaced by PanAm with solid dural-bladed propellers. Following C.A.A. certification of the installation, which is expected soon, PanAm will convert all of its 26 Stratocruisers which operate the airline's Pacific and Atlantic routes.

## MANCHESTER TO THE CONTINENT BY EAGLE

SCHEDULED Viking services from Manchester to Switzerland, Germany and Scandinavia are to be operated by Eagle. These will be the company's first scheduled activities based on the United Kingdom's second city—present operations are from London. The first service, an air-coach operation to Switzerland, will start on May 31. A once-weekly service, it will link Manchester with Basle *via* Luxemburg. Later, on June 3, thrice-weekly flights will start to the four Scandinavian countries.

*One of East Germany's exhibits at the Leipzig International Fair which ended yesterday, March 14, was an Il-14P built under licence at Dresden for the East German airline. In the background is the Soviet Pavilion.*

# CIVIL AVIATION . . .



*On pages 326 and 327 of this issue we record A.W.A.'s progress with their Freighter/Coach project. Here is a cut-away impression of the Model 670 vehicle-ferry version, showing the accommodation for six cars and 30 passengers.*

## BERMUDA REVISIONS

TALKS going on between Britain and the U.S.A. about revisions to the 1946 Bermuda agreement have, according to an American source, "blown up." The background to these discussions was briefly explained in *Flight* of November 16 last. Official post-conference communiques from the respective governments have revealed very little, but the intricacy and delicacy of the discussions is apparent from the fact that they have been going on, at intervals, for eighteen months. The outcome of the latest talks, which took place in Bermuda, is—according to *American Aviation Daily*—that the British route requirements are of such "immense magnitude" that a further period of two months will have to elapse while their implications are discussed between the American carriers and the U.S. Government.

## ELECTRA ENGINE PROGRAMME

IN our final issue of 1956 we recorded the steps that Lockheed are taking to ensure that the Electra's Allison D-13 engines will be fully developed when the airliner enters service in 1958. The programme then envisaged—which was for a "head start" of 800,000 engine hours—has since been extended. Lockheed and Allison hope that two million engine hours will have been accumulated (much by the U.S.A.F.) by the time the aircraft reaches European service, although it can be assumed that the first American operators to get delivery will contribute to this formidable total.

The civil D-13 engine fitted to "Old 1961" Constellation is now nearly ready for flight, and a complete re-engining of a Super Constellation should be completed in July. Next year the engines will be proved in flight tests with five Electras and the military T-56 engines of the Lockheed C-130 have sufficient similarity to enable development experience to be obtained from the tests proceeding at Lockheed's Marietta base. The U.S.A.F. should have accumulated over 500,000 engine hours on C-130As before the Electra is in commercial operation.

The Allison Division's test programme has already accumulated more than 40,000 hours of running time. One unit is simulating an airline schedule in 52-minute, two-, four- and six-hour periods for fifteen hours a day; a realistic pattern of start, taxi, take-off, climb, cruise, let-down, prop reverse and stop is being followed. Numerous engines are being tested on stands, in-flight development will eventually be extended to six aircraft (including an Electra), and Allison are also heading towards C.A.A. certification of the engine and propeller.

*The first Ethiopian Airlines captain to be given a command (after six years as a second pilot) is Capt. Alemayehu Abebe, 32. He is seen here being congratulated at Addis Ababa by Mr. Victor Harrell, general manager of the T.W.A.-administered and -operated Ethiopian airline.*

## FLIGHT-TIME LIMITATIONS

NEARLY a year ago the Minister of Transport and Civil Aviation introduced the first draft proposals for limiting the duty periods of flight crews. (The only existing regulation required that a pilot should have a medical examination if he flew more than a certain number of hours in a month.) It was apparent that, if pilot fatigue was not to menace safety, a limit must be placed upon the duration of cockpit duty. And the limits should take into account the type of route being flown; obviously the strain induced by multi-stop airways flying at night in dirty weather exceeds that of a non-stop long-haul flight in daylight.

The draft proposals evaded the detailed legislation required for such differentiation by suggesting only maximum daily duty-periods. These were, for one pilot, 12 hours; for two pilots 16 hours; and for three pilots (with a rest-bunk) 24 hours. The onus of reducing these limits on arduous routes was laid at the door of the operator, whose prescribed reductions (written into the operations manual) would be subject to Ministerial scrutiny.

These proposals met with sharp disapproval by both B.A.L.P.A. and G.A.P.A.N., the former arguing that law without loopholes should be framed. They feared that unless legislation defined the *conditions* of operation, some airlines might increase the pilot's work-load up to or near to the maximum limits laid down. They also wanted a limit to be set on the yearly total of hours flown, to be less than twelve times the 125-hour monthly maximum.

But when—as we recorded last week—new legislation governing flight-time limitations was laid before Parliament in the shape of the Air Navigation (Fifth Amendment) Order, 1957, little change had been made from the proposals of nearly a year before. The only significant difference was that "at-the-captain's-discretion" clauses had been introduced to allow the operators' and Ministry's limits to be *exceeded*: a principle strongly opposed by those who argue that the tired pilot is the one least likely to make the correct decision, particularly if it is in conflict with his loyalty. The pilots' representatives feel very strongly that, in eleven months in which little more has been done than to write the limitations in stodgy legalese, their advice has been ignored. Limitations cannot, they say, be made on fair-weather probabilities; and if operators' manuals are to be used as a working basis for limited duty times, then air safety demands that these should by law be submitted to the Minister for scrutiny.

When jet transports are in service, flight-time limitations will be left almost entirely to the operators to decide, because the Ministry's limits are likely to be too high to be realistic.

In the meantime, the spirit of the new legislation rather than its letter will have to be observed by pilots and operators alike if detriment to air safety and disagreements between the pilots' associations and the operators is to be avoided.

*Snowstorm take-off at Boeing Field by the 707 prototype, which is pressing on with its flight-tests in wintry Seattle.*

## A SURVEY OF ACCIDENTS

FROM the M.T.C.A.'s latest *Survey of Accidents to Aircraft of the United Kingdom* (for the year ending December 31, 1955) we reproduce the table below, summarizing the essential accident statistics for the years 1950 and 1955. It will be noted that the fatal-accident rate, measured as passengers killed per 100 million passenger miles, shows a downward trend. Copies of the survey are obtainable at 2s 6d from H.M. Stationery Office.

**ACCIDENTS ON REGULAR PASSENGER SERVICES OF U.K. OPERATORS, 1950-1955**

| | 1954 | 1955 | 1950-54 | 1951-55 |
|---|---|---|---|---|
| Stage flights per fatal accident ... ... | 58,100 | 95,400 | 107,400 | 116,800 |
| Stage flights per accident involving death or serious injury ... ... ... ... | 58,100 | 63,600 | 107,400 | 102,200 |
| Aircraft miles flown per fatal accident ... | 19,032,700 | 32,290,500 | 38,405,000 | 41,217,100 |
| Aircraft miles flown per accident involving death or serious injury ... ... ... | 19,032,700 | 21,527,000 | 38,405,000 | 36,065,000 |
| Passengers carried per passenger killed ... | 29,100 | 230,300 | 46,100 | 68,200 |
| Passengers carried per passenger killed or seriously injured ... ... ... ... | 28,700 | 142,600 | 44,100 | 61,900 |
| Passenger miles per passenger killed ... | 18,004,700 | 138,569,800 | 31,152,900 | 44,625,000 |
| Passenger miles per passenger killed or seriously injured ... ... ... ... | 17,792,900 | 85,781,300 | 29,771,700 | 40,522,000 |
| Fatal accidents per 10,000 stage flights ... | 0.17 | 0.11 | 0.09 | 0.09 |
| Fatal accidents per 1,000,000 aircraft miles | 0.05 | 0.03 | 0.03 | 0.02 |
| **Passengers killed per 100,000,000 passenger miles ... ... ... ...** | **5.6** | **0.7** | **3.2** | **2.2** |

## FRIENDSHIPS TO CHECK AUSTRALIAN AIDS

CONFIRMATION of the Australian Government's order for two Friendships (previously forecast in *Flight*) is now forthcoming from Fokker. The aeroplanes will replace DC-3s used by the Australian Department of Civil Aviation for checking and calibrating the country's radio navigation and safety aids. They will also be used for routine checking of commercial airline pilots. About a ton of special equipment will be installed in each aircraft.

From *Aviation Week* comes an unconfirmed report that Sabena are likely in the next few weeks to place an order for between ten and 15 Friendships.

## THE PILOTS TAKE STOCK

MILITANT though moderate in its efforts to ensure that the pilot plays his due part in the shaping of air transport affairs, the International Federation of Air Line Pilots' Associations cannot be accused of wisdom-after-the-event or hindsight in its technical recommendations.

Looking back at the year 1956, the Federation appears to have good cause for satisfaction. In that year recommendations matured which I.F.A.L.P.A. had been putting before the authorities for two or three years. "It is," writes the technical secretary in his annual report, "a sad reflection on the aviation industry that there has to be this two-to-three-year lag before a requirement which has been obvious to pilots for some time can be recognized by others."

Examples were: (1) The introduction of 100-per-cent-controlled flight in the U.S. at levels above 24,000ft, with early prospects of 35,000ft. This regulation was introduced after the Grand Canyon disaster, but had been on I.F.A.L.P.A. books for four years. (2) Recognition that jets required at least the same margin above the stall as piston-engined types. Acceptable Means of Compliance had been introduced by the I.C.A.O. Third Air Navigation Conference after two Comet take-off accidents at less than the conventional margin—a recommendation on the I.F.A.L.P.A. books for four years. (3) Recognition of the value of buoyant cushions for ditching. A C.A.A. proposal had been introduced after the North-west ditching in Puget Sound, after I.F.A.L.P.A. had sought this for three years. (4) Recognition of the need for an anti-collision device, demanded by the airlines after recent mid-air collisions, but which had been on I.F.A.L.P.A.'s books for four years.

## THIRTY-MINUTE TRIUMPH

THE possibility that the crowded story of world air transport could be illustrated in a half-hour film might be considered remote. Certainly the Shell Film Unit must have had some misgivings when, at I.A.T.A.'s suggestion early in 1955, they decided to attempt the feat.

Their new film *Song of the Clouds*, privately shown in London last week, achieves the seemingly improbable: in the space of 30-odd minutes it distils the very essence of air commerce today as no film, to our knowledge, has done before. It was made from ten miles of colour film (shot by a film crew which travelled 75,000 miles) selectively edited to 4,000ft of the choicest aviation photography yet screened. *Song of the Clouds*, directed by John Armstrong, moves with a zip appropriate to the pace of its subject.

Copies (16 mm or 35 mm, with sound) can be borrowed free by approved organizations from the Petroleum Films Bureau, 39 New Bond Street, London, W.1, or from the Shell company in the country concerned.

## JET SPRINGBOK?

SOUTH AFRICAN AIRWAYS' healthy financial position—the estimated profit last year was £1,122,000—and the circulation by the airline of a questionnaire seeking technical information on jet aircraft has been the signal for some ardent wooing by aircraft companies offering jet transports, says a South African correspondent. A report that the South African Minister of Transport will authorize the purchase of three new airliners has brought representatives of de Havilland, Boeing and Douglas to Jan Smuts Airport, Johannesburg, and Lockheed agents are also on hand to press the virtues of the Electra.

## THE BRISTOL 200

SPECULATION about the Bristol jet transport project which Mr. Peter Masefield has publicly said is now undergoing wind-tunnel tests was heightened last week by American reports that it is to be powered by four Bristol B.E.47 engines, a new 6,000lb-thrust design which is reported to be offered also for the Vickers jet transport project. Designation of the Bristol transport is said to be Bristol 200.

A British newspaper report last week stated that B.O.A.C. and B.E.A., as suggested in *Flight* of February 22 (page 233), had decided that their jet transport requirements could not be met in a single design.

*Passengers on the first B.O.A.C. Britannia service on March 2 to Australia included Mr. C. F. Uwins (right), chairman of Bristol Aircraft, with Mrs. Uwins; and Sir George Cribbett, deputy chairman of B.O.A.C., who was flying as far as Zürich. They were being seen off by B.O.A.C.'s commercial director, Mr. Keith Granville.*

*Steadily and unobtrusively, U.K. independent airlines are building up their revenues from freight business. Here are (left) motor car spares bound for Central Africa by Hunting-Clan York, and (right) office equipment being dispatched to Europe by Starways DC-3.*

## CIVIL AVIATION . . .

### FLIGHT ENGINEERS AND THE BRITANNIA

IT will be recalled that, on the eve of the Britannia's entry into B.O.A.C. service at the beginning of last month, the Corporation's flight engineers threatened to strike over their demand for a separate engineer's station in the aircraft. At the last moment this threatened action, which would have affected all B.O.A.C.'s other fleets, was averted, and the Government appointed a court to "inquire into the causes and circumstances of the dispute and to report."

This report was published on March 7. It does not (and was not expected to) settle the issue, but it suggests that a tripartite working party with participation by the pilots as well as by the engineers and the employer should be established to resolve the problem. It regrets that pilots were not properly represented on the previous working party when the dispute was at its height.

B.O.A.C. Britannia Fleet captains told the court, says the report, that they did not consider it was necessary for the Britannia to have an engineer officer. The engineers, on the other hand, argued that they must have a separate station to contribute to the highest operational standards. B.O.A.C. pointed out that Argonauts and Viscounts were operated without engineer officers, and that the Britannia had been operated successfully for 8,000 hours, under arrangements made before the dispute, without an engineer officer.

The report emphasizes that at no stage in the dispute had there been any criticism of the Britannia as an aircraft. The matter of safety had not been in question, and it was accepted by all parties that operation of the aircraft complied with statutory requirements. The court's decision was that the dispute was industrial and not technical. In the meantime, the interim arrangements accepted by the parties to the dispute—i.e., that the aircraft should have an engineer officer, in the jump-seat position—should be continued.

The history of the dispute is that B.O.A.C.'s original policy was to operate the Britannia without an engineer officer. This policy was reversed in September 1953; and in October 1956 it was agreed that his position should be in the jump seat. But the engineers' organization (the Merchant Navy and Air Line Officers' Association) was still dissatisfied, and remained so up to the inauguration of services.

The engineers' main quarrel, the report says, was with the performance of more than one function by the same officer, and with the "procrastination and inconsistency" which, they maintained, B.O.A.C. had shown since 1949 in dealing with the engineer officers' duties. B.O.A.C. contended that they had a duty to take full advantage of technical progress. The problem could have been dealt with by the proper negotiating machine, and the strike threat was a "serious constitutional breach."

Other points raised in the report include the pilots' view that Britannia engineering duties are so small that the shedding of load to an engineer officer does not make a significant contribution to the share of the work load. They thought that the jump seat should be occupied by someone who "contributed most to efficient operation," otherwise the insertion of a crew member hampered their duties. The engineers contended that payment to pilots of extra allowances in cases where an engineer, communicator or navigator was not carried on four-engined long-haul aircraft (£200 or £480 per year, according to which officer was omitted) showed that technical development had not justified the exclusion of the engineer.

The dispute seems unlikely to be settled for some months. The final solution will set a precedent for similar decisions which may have to be taken in the future, and which will determine whether or not the flight engineer will eventually give way to technical progress.

# BREVITIES

LAST week we published a photograph of the nose of the first production Boeing 707 being swung on to the production line. The DC-8 is keeping pace: it is reported that production assembly—also starting with the nose structure—has begun on schedule at Douglas' Long Beach factory.

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Mr. P. W. Haddy, general manager of the Adelaide Steamship Company, has been elected chairman of Australian National Airways in succession to the late Sir Ivan Holyman.

* * *

At the inauguration of Sabena's Brussels-Paris helicopter service on March 3, eight S-58s took off from the Allée Verte heliport in Brussels to fly to the Issy-les-Moulineaux heliport, Place Balard, Paris. The regular service will be flown at a frequency of five flights daily in each direction and one flight on Sundays.

* * *

*Mr. John Thoresen*

Minor troubles dogged the first B.O.A.C. Britannia 102 return service from Australia: a starter motor had to be changed at Darwin and a hydraulic pump at Jakarta.

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Skyways have announced that Mr. John Thoresen, portrayed on the left, has been appointed general manager in France, with headquarters in Paris.

It has been announced by the World Bank that Air-India International is to borrow £6m to finance the purchase of its three Boeing 707-420s—£2m from the World Bank and £4m from U.S. commercial banks. The airline will then still require to find a further £1.9m.

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Two Link Aviation flight simulators—a DC-8 and an Electra—have been ordered by Eastern Air Lines.

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An Alaska Airlines' DC-4 crashed 50 miles north-east of Seattle on March 3 while on a flight between Fairbanks and Seattle. All five on board, including two passengers, lost their lives.

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Braniff will equip their 707s and Electras with the Collins FD-105 Flight Director System.

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Mr. William B. Davis has been appointed deputy administrator of the Civil Aeronautics Administration.

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Lufthansa's South American routes will be extended to Montevideo on April 17 and later to Santiago.

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The Air Registration Board have re-issued B.C.A.R.s Section C *Engines and Propellers*—now Issue 4; the list of contents to B.C.A.Rs. is now Issue 27.

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I.A.T.A. have extended for an additional 90 days (until June 30) off-season emigrant air fares from Europe to Canada.

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Air-India hope to use Cairo Airport as a traffic stop on their London-Bombay services from April 1.